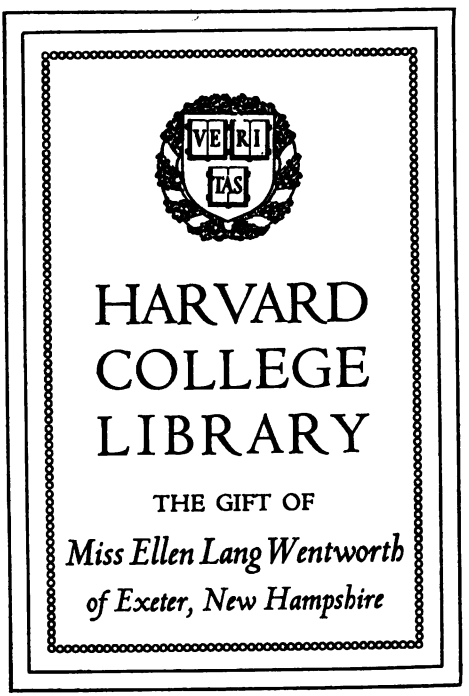

(1)

ELEMENTS OF ALGEBRA.

chap. v, x, xii, xv, xix

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CHAPTER V.

Simple Equations.

106. An **equation** is a statement that two expressions are equal. Thus, $4x - 12 = 8$.

107. Every equation consists of two parts, called the first and second *sides*, or *members*, of the equation.

108. An **identical equation** is one in which the two sides are equal, whatever numbers the letters stand for. Thus, $(x + b)(x - b) = x^2 - b^2$.

109. An **equation of condition** is one which is true only when the letters stand for particular values. Thus, $x + 5 = 8$ is true only when $x = 3$.

110. A letter to which a particular value must be given in order that the statement contained in an equation may be true is called an *unknown quantity*.

111. The *value* of the unknown quantity is the **number** which substituted for it will *satisfy* the equation, and is called a *root* of the equation.

112. To **solve** an equation is to find the value of the unknown quantity.

113. A **simple equation** is one which contains only the *first* power of the unknown quantity, and is also called an equation of the *first degree*.

114. *If equal changes be made in both sides of an equation, the results will be equal.* § 43.

(1) To find the value of x in $x + b = a$.

$$x + b = a;$$

Subtract b from each side, $x + b - b = a - b;$

Cancel $+ b - b$, $x = a - b.$

(2) To find the value of x in $x - b = a$.

$$x - b = a;$$

Subtract $- b$ from each side, $x - b + b = a + b;$

Cancel $- b + b$, $x = a + b.$

The result in each case is the same as if b were transposed to the other side of the equation with its sign changed. Therefore,

115. *Any term may be transposed from one side of an equation to the other provided its sign be changed.*

For, in this transposition, the same number is subtracted from each side of the equation.

116. The signs of all the terms on each side of an equation may be changed; for, this is in effect transposing every term.

117. When the known and unknown quantities of an equation are connected by the sign $+$ or $-$, they may be separated by transposing the known quantities to one side and the unknown to the other.

118. Hence, to solve an equation with one unknown quantity,

Transpose all the terms involving the unknown quantity to the left side, and all the other terms to the right side:

combine the like terms, and divide both sides by the coefficient of the unknown quantity.

119. To verify the result, substitute the value of the unknown quantity in the original equation.

EXERCISE XXVIII.

Find the value of x in

1. $5x-1=19$.
2. $3x+6=12$.
3. $24x=7x+34$.
4. $8x-29=26-3x$.
5. $12-5x=19-12x$.
6. $3x+6-2x=7x$.
7. $5x+50=4x+56$.
8. $16x-11=7x+70$.
9. $24x-49=19x-14$.
10. $3x+23=78-2x$.
11. $26-8x=80-14x$.
12. $13-3x=5x-3$.
13. $3x-22=7x+6$.
14. $8+4x=12x-16$.
15. $5x-(3x-7)=4x-(6x-35)$.
16. $6x-2(9-4x)+3(5x-7)=10x-(4+16x+35)$.
17. $9x-3(5x-6)+30=0$.
18. $x-7(4x-11)=14(x-5)-19(8-x)-61$.
19. $(x+7)(x-3)=(x-5)(x-15)$.
20. $(x-8)(x+12)=(x+1)(x-6)$.
21. $(x-2)(7-x)+(x-5)(x+3)-2(x-1)+12=0$.
22. $(2x-7)(x+5)=(9-2x)(4-x)+229$.
23. $14-x-5(x-3)(x+2)+(5-x)(4-5x)=45x-76$.
24. $(x+5)^2-(4-x)^2=21x$.
25. $5(x-2)^2+7(x-3)^2=(3x-7)(4x-19)+42$.

Exercise XXIX.

PROBLEMS.

1. Find a number such that when 12 is added to its double the sum shall be 28.

Let x = the number.
Then $2x$ = its double,
and $2x + 12$ = double the number increased by 12.
But 28 = double the number increased by 12.
$\therefore 2x + 12 = 28.$
$2x = 28 - 12,$
$2x = 16,$
$x = 8.$

2. A farmer had two flocks of sheep, each containing the same number. He sold 21 sheep from one flock and 70 from the other, and then found that he had left in one flock twice as many as in the other. How many had he in each?

Let x = number of sheep in each flock.
Then $x - 21$ = number of sheep left in one flock,
and $x - 70$ = number of sheep left in the other.
$\therefore x - 21 = 2(x - 70),$
$x - 21 = 2x - 140.$
$x - 2x = -140 + 21,$
$-x = -119,$
$x = 119.$

3. A and B had equal sums of money; B gave A \$5, and then 3 times A's money was equal to 11 times B's money. What had each at first?

Let x = number of dollars each had.
Then $x + 5$ = number of dollars A had after receiving \$5 from B,
and $x - 5$ = number of dollars B had after giving A \$5.

$$\therefore 3(x+5) = 11(x-5),$$
$$3x+15 = 11x-55.$$
$$3x-11x = -55-15.$$
$$-8x = -70,$$
$$x = 8\tfrac{3}{4}.$$

Therefore, each had $8.75.

4. Find a number whose treble exceeds 50 by as much as its double falls short of 40.

Let x = the number.
Then $3x$ = its treble,
and $3x-50$ = the excess of its treble over 50;
also, $40-2x$ = the number its double lacks of 40.
$\therefore 3x-50 = 40-2x;$
$3x+2x = 40+50.$
$5x = 90,$
$x = 18.$

5. What two numbers are those whose difference is 14, and whose sum is 48?

Let x = the larger number.
Then $48-x$ = the smaller number,
and $x-(48-x)$ = the difference of the numbers.
But 14 = the difference of the numbers.
$\therefore x-(48-x) = 14.$
$x-48+x = 14;$
$2x = 62;$
$x = 31.$

Therefore, the two numbers are 31 and 17.

6. To the double of a certain number I add 14, and obtain as a result 154. What is the number?

7. To four times a certain number I add 16, and obtain as a result 188. What is the number?

8. By adding 46 to a certain number, I obtain as a result a number three times as large as the original number. Find the original number.

9. One number is three times as large as another. If I take the smaller from 16 and the greater from 30, the remainders are equal. What are the numbers?

10. Divide the number 92 into four parts, such that the first exceeds the second by 10, the third by 18, and the fourth by 24.

11. The sum of two numbers is 20; and if three times the smaller number be added to five times the greater, the sum is 84. What are the numbers?

12. The joint ages of a father and son are 80 years. If the age of the son were doubled, he would be 10 years older than his father. What is the age of each?

13. A man has 6 sons, each 4 years older than the next younger. The eldest is three times as old as the youngest. What is the age of each?

14. Add $24 to a certain sum and the amount will be as much above $80 as the sum is below $80. What is the sum?

15 Thirty yards of cloth and 40 yards of silk together cost $330; and the silk cost twice as much a yard as the cloth. How much does each cost a yard?

16. Find the number whose double increased by 24 exceeds 80 by as much as the number itself is less than 100.

17. The sum of $500 is divided among A, B, C, and D. A and B have together $280, A and C $260, and A and D $220. How much does each receive?

18. In a company of 266 persons composed of men, women, and children, there are twice as many men as women, and twice as many women as children. How many are there of each?

19. Find two numbers differing by 8, such that four times the less may exceed twice the greater by 10.

20. A is 58 years older than B, and A's age is as much above 60 as B's age is below 50. Find the age of each.

21. A man leaves his property, amounting to $7500, to be divided among his wife, his two sons, and three daughters, as follows: a son is to have twice as much as a daughter, and the wife $500 more than all the children together. How much was the share of each?

22. A vessel containing some water was filled by pouring in 42 gallons, and there was then in the vessel seven times as much as at first. How much did the vessel hold?

23. A has $72 and B has $52. B gives A a certain sum; then A has three times as much as B. How much did A receive from B?

24. Divide 90 into two such parts that four times one part may be equal to five times the other.

25. Divide 60 into two such parts that one part exceeds the other by 24.

26. Divide 84 into two such parts that one part may be less than the other by 36.

NOTE I. When we have to compare the ages of two persons at a given time, and also a number of years after or before the given time, we must remember that *both* persons will be so many years older or younger.

Thus, if x represent A's age, and $2x$ B's age, at the present time, A's age five years ago will be represented by $x-5$; and B's by $2x-5$. A's age five years hence will be represented by $x+5$; and B's age by $2x+5$.

27. A is twice as old as B, and 22 years ago he was three times as old as B. What is A's age?

28. A father is 30 and his son 6 years old. In how many years will the father be just twice as old as the son?

29. A is twice as old as B, and 20 years since he was three times as old. What is B's age?

30. A is three times as old as B, and 19 years hence he will be only twice as old as B. What is the age of each?

31. A man has three nephews; his age is 50, and the joint ages of the nephews is 42. How long will it be before the joint ages of the nephews will be equal to that of the uncle?

NOTE II. In problems involving quantities of the same kind expressed in different units, we must be careful to reduce all the quantities to the *same unit*.

Thus, if x denote a number of inches, all the quantities of the same kind involved in the problem must be reduced to inches.

32. A sum of money consists of dollars and twenty-five-cent pieces, and amounts to $20. The number of coins is 50. How many are there of each sort?

33. A person bought 30 pounds of sugar of two different kinds, and paid for the whole $2.94. The better kind cost 10 cents a pound and the poorer kind 7 cents a pound. How many pounds were there of each kind?

34. A workman was hired for 40 days, at $1 for every day he worked, but with the condition that for every day he did not work he was to pay 45 cents for his board. At the end of the time he received $22.60. How many days did he work?

35. A wine merchant has two kinds of wine; one worth 50 cents a quart, and the other 75 cents a quart. From these he wishes to make a mixture of 100 gallons, worth $2.40 a gallon. How many gallons must he take of each kind.

36. A gentleman gave some children 10 cents each, and had a dollar left. He found that he would have required one dollar more to enable him to give them 15 cents each. How many children were there?

37. Two casks contain equal quantities of vinegar; from the first cask 34 quarts are drawn, from the second, 20 gallons; the quantity remaining in one vessel is now twice that in the other. How much did each cask contain at first?

38. A gentleman hired a man for 12 months, at the wages of $90 and a suit of clothes. At the end of 7 months the man quits his service and receives $33.75 and the suit of clothes. What was the price of the suit of clothes?

39. A man has three times as many quarters as half-dollars, four times as many dimes as quarters, and twice as many half-dimes as dimes. The whole sum is $7.30. How many coins has he altogether?

40. A person paid a bill of $15.25 with quarters and half-dollars, and gave 51 pieces of money altogether. How many of each kind were there?

41. A bill of 100 pounds was paid with guineas (21 shillings) and half-crowns (2½ shillings), and 48 more half-crowns than guineas were used. How many of each were paid?

CHAPTER X.

PROBLEMS.

EXERCISE LXVII.

Ex. Find the number the sum of whose third and fourth parts is equal to 12.

Let x = the number.

Then $\frac{x}{3}$ = the third part of the number,

and $\frac{x}{4}$ = the fourth part of the number,

$\therefore \frac{x}{3}+\frac{x}{4}$ = the sum of the two parts.

But 12 = the sum of the two parts,

$\therefore \frac{x}{3}+\frac{x}{4}=12.$

Multiply both sides by 12:

$4x+3x=144,$

$7x=144,$

$\therefore x=20\frac{4}{7}.$

1. Find the number whose third and fourth parts together make 14.
2. Find the number whose third part exceeds its fourth part by 14.
3. The half, fourth, and fifth of a certain number are together equal to 76; find the number.
4. Find the number whose double exceeds its half by 12.
5. Divide 60 into two such parts that a seventh of one part may be equal to an eighth of the other.

6. Divide 50 into two such parts that a fourth of one part increased by five-sixths of the other part may be equal to 40.

7. Divide 100 into two such parts that a fourth of one part diminished by a third of the other part may be equal to 11.

8. The sum of the fourth, fifth, and sixth parts of a certain number exceeds the half of the number by 112. What is the number?

9. The sum of two numbers is 5760, and their difference is equal to one-third of the greater. What are the numbers?

10. Divide 45 into two such parts that the first part divided by 2 shall be equal to the second part multiplied by 2.

11. Find a number such that the sum of its fifth and its seventh parts shall exceed the difference of its fourth and its seventh parts by 99.

12. In a mixture of wine and water, the wine was 25 gallons more than half of the mixture, and the water 5 gallons less than one-third of the mixture. How many gallons were there of each?

13. In a certain weight of gunpowder the saltpetre was 6 pounds more than half of the weight, the sulphur 5 pounds less than the third, and the charcoal 3 pounds less than the fourth of the weight. How many pounds were there of each?

14. Divide 46 into two parts such that if one part be divided by 7, and the other by 3, the sum of the quotients shall be 10.

15. A house and garden cost \$850, and five times the price of the house was equal to twelve times the price of the garden. What is the price of each?

16. A man leaves the half of his property to his wife, a sixth to each of his two children, a twelfth to his brother, and the remainder, amounting to \$600, to his sister. What was the amount of his property?

17. The sum of two numbers is a and their difference is b; find the numbers.

18. Find two numbers of which the sum is 70, such that the first divided by the second gives 2 as a quotient and 1 as a remainder.

19. Find two numbers of which the difference is 25, such that the second divided by the first gives 4 as a quotient and 4 as a remainder.

20. Divide the number 208 into two parts such that the sum of the fourth of the greater and the third of the smaller is less by 4 than four times the difference of the two parts.

21. Find four consecutive numbers whose sum is 82.

NOTE I. It is to be remembered that if x represent a person's age at the present time, his age a years ago will be represented by $x - a$, and a years hence by $x + a$.

EX. In eight years a boy will be three times as old as he was eight years ago. How old is he?

Let x = the number of years of his age.

Then $x - 8$ = the number of years of his age eight years ago,

and $x + 8$ = the number of years of his age eight years hence,

$$\therefore x + 8 = 3(x - 8),$$
$$x + 8 = 3x - 24,$$
$$x - 3x = -24 - 8,$$
$$-2x = -32,$$
$$x = 16.$$

22. A is 72 years old, and B's age is two-thirds of A's. How long is it since A was five times as old as B?

23. A mother is 70 years old, her daughter is half that age. How long is it since the mother was three and one-third times as old as the daughter?

24. A father is three times as old as the son; four years ago the father was four times as old as the son then was. What is the age of each?

25. A is twice as old as B, and seven years ago their united ages amounted to as many years as now represent the age of A. Find the ages of A and B.

26. The sum of the ages of a father and son is half what it will be in 25 years; the difference is one-third what the sum will be in 20 years. What is the age of each?

NOTE II. If A can do a piece of work in x days, the part of the work that he can do in one day will be represented by $\frac{1}{x}$. Thus, if he can do the work in 5 days, in 1 day he can do $\frac{1}{5}$ of the work.

Ex. A can do a piece of work in 5 days, and B can do it in 4 days. How long will it take A and B together to do the work?

Let x = the number of days it will take A and B together.
Then $\frac{1}{x}$ = the part they can do in one day.
Now, $\frac{1}{5}$ = the part A can do in one day,
and $\frac{1}{4}$ = the part B can do in one day.
$\therefore \frac{1}{5} + \frac{1}{4}$ = the part A and B can do in one day.

$$\therefore \frac{1}{5} + \frac{1}{4} = \frac{1}{x},$$
$$4x + 5x = 20,$$
$$9x = 20,$$
$$x = 2\tfrac{2}{9}.$$

Therefore they will do the work in $2\frac{2}{9}$ days.

27. A can do a piece of work in 5 days, B in 6 days, and C in $7\frac{1}{2}$ days; in what time will they do it, all working together?

28. A can do a piece of work in $2\frac{1}{2}$ days, B in $3\frac{1}{3}$ days, and C in $3\frac{3}{4}$ days; in what time will they do it, all working together?

29. Two men who can separately do a piece of work in 15 days and 16 days, can, with the help of another, do it in 6 days. How long would it take the third man to do it alone?

30. A can do half as much work as B, B can do half as much as C, and together they can complete a piece of work in 24 days. In what time can each alone complete the work?

31. A does $\frac{5}{9}$ of a piece of work in 10 days, when B comes to help him, and they finish the work in 3 days more. How long would it have taken B alone to do the whole work?

32. A and B together can reap a field in 12 hours, A and C in 16 hours, and A by himself in 20 hours. In what time can B and C together reap it? In what time can A, B, and C together reap it?

33. A and B together can do a piece of work in 12 days, A and C in 15 days, B and C in 20 days. In what time can they do it, all working together?

NOTE III. If a pipe can fill a vessel in x hours, the part of the vessel filled by it in one hour will be represented by $\frac{1}{x}$. Thus, if a pipe will fill a vessel in 3 hours, in 1 hour it will fill $\frac{1}{3}$ of the vessel.

34. A tank can be filled by two pipes in 24 minutes and 30 minutes respectively, and emptied by a third in 20 minutes. In what time will it be filled if all three are running together?

35. A tank can be filled in 15 minutes by two pipes, A and B, running together. After A has been running by

itself for 5 minutes, B is also turned on, and the tank is filled in 13 minutes more. In what time may it be filled by each pipe separately?

36. A cistern could be filled by two pipes in 6 hours and 8 hours respectively, and could be emptied by a third in 12 hours. In what time would the cistern be filled if the pipes were all running together?

37. A tank can be filled by three pipes in 1 hour and 20 minutes, 3 hours and 20 minutes, and 5 hours, respectively. In what time will the tank be filled when all three pipes are running together?

38. If three pipes can fill a cistern in a, b, and c minutes, respectively, in what time will it be filled by all three running together?

39. The capacity of a cistern is $755\frac{1}{4}$ gallons. The cistern has three pipes, of which the first lets in 12 gallons in $3\frac{1}{4}$ minutes, the second $15\frac{1}{8}$ gallons in $2\frac{1}{2}$ minutes, the third 17 gallons in 3 minutes. In what time will the cistern be filled by the three pipes running together?

NOTE IV. In questions involving distance, time, and rate:

$$\frac{\text{Distance}}{\text{Rate}} = \text{Time}.$$

Thus, if a man travels 40 miles at the rate of 4 miles an hour,

$$\frac{40}{4} = \text{number of hours required}.$$

EX. A courier who goes at the rate of $31\frac{1}{2}$ miles in 5 hours, is followed, after 8 hours, by another who goes at the rate of $22\frac{1}{2}$ miles in 3 hours. In how many hours will the second overtake the first?

Since the first goes $31\frac{1}{2}$ miles in 5 hours, his rate per hour is $6\frac{3}{10}$ miles.

Since the second goes $22\frac{1}{2}$ miles in 3 hours, his rate per hour is $7\frac{1}{2}$ miles.

Let x = the number of hours the first is travelling.
Then $x - 8$ = the number of hours the second is travelling.
Then $6\frac{3}{10}\,x$ = the number of miles the first travels;
$(x - 8)\,7\frac{1}{2}$ = the number of miles the second travels.
They both travel the same distance,

$$\therefore\ 6\tfrac{3}{10}\,x = (x - 8)\,7\tfrac{1}{2}.$$

The solution of which gives 42 hours.

40. A sets out and travels at the rate of 7 miles in 5 hours. Eight hours afterwards, B sets out from the same place and travels in the same direction, at the rate of 5 miles in 3 hours. In how many hours will B overtake A?

41. A person walks to the top of a mountain at the rate of $2\frac{1}{3}$ miles an hour, and down the same way at the rate of $3\frac{1}{2}$ miles an hour, and is out 5 hours. How far is it to the top of the mountain?

42. A person has a hours at his disposal. How far may he ride in a coach which travels b miles an hour, so as to return home in time, walking back at the rate of c miles an hour?

43. The distance between London and Edinburgh is 360 miles. One traveller starts from Edinburgh and travels at the rate of 10 miles an hour; another starts at the same time from London, and travels at the rate of 8 miles an hour. How far from London will they meet?

44. Two persons set out from the same place in opposite directions. The rate of one of them per hour is a mile less than double that of the other, and in 4 hours they are 32 miles apart. Determine their rates.

45. In going a certain distance, a train travelling 35 miles an hour takes 2 hours less than one travelling 25 miles an hour. Determine the distance.

NOTE V. In problems relating to clocks, it is to be observed that the minute-hand moves *twelve times* as fast as the hour-hand.

Ex. Find the time between two and three o'clock when the hands of a clock are:

I. Together.

II. At right angles to each other.

III. Opposite to each other.

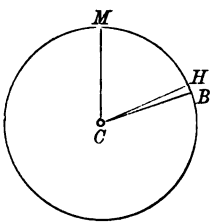

Fig. 1.

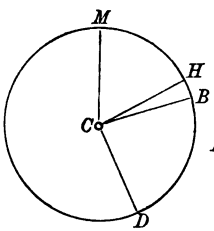

Fig. 2.

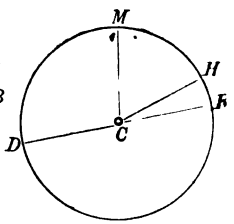

Fig. 3.

I. Let CH and CM (Fig. 1) denote the positions of the hour and minute hands at 2 o'clock, and CB the position of both hands when together.

Then arc HB = *one-twelfth* of arc MB.

Let x = number of minute-spaces in arc MB.

Then $\frac{x}{12}$ = number of minute-spaces in arc HB,

and 10 = number of minute-spaces in arc MH.

Now arc MB = arc MH + arc HB.

That is, $x = 10 + \frac{x}{12}$.

The solution of this equation gives $x = 10\frac{10}{11}$.

Hence, the time is $10\frac{10}{11}$ minutes past 2 o'clock.

II. Let CB and CD (Fig. 2) denote the positions of the hour and minute hands when at right angles to each other.

Let x = number of minute-spaces in arc $MHBD$.

Then $\frac{x}{12}$ = number of minute-spaces in arc HB,

and 10 = number of minute-spaces in arc MH.

15 = number of minute-spaces in arc BD.

Now arc $MHBD$ = arcs $MH + HB + BD$.

That is, $x = 10 + \frac{x}{12} + 15$.

The solution of this equation gives $x = 27\frac{3}{11}$.

Hence, the time is $27\frac{3}{11}$ minutes past 2 o'clock.

III. Let CB and CD (Fig. 3) denote the positions of the hour and minute hands when opposite to each other.

Let x = number of minute-spaces in arc $MHBD$.

Then $\frac{x}{12}$ = number of minute-spaces in arc HB,

and 10 = number of minute-spaces in arc MH,

30 = number of minute-spaces in arc BD.

Now arc $MHBD$ = arcs $MH + HB + BD$.

That is, $x = 10 + \frac{x}{12} + 30$.

The solution of this equation gives $x = 43\frac{7}{11}$.

Hence, the time is $43\frac{7}{11}$ minutes past 2 o'clock.

46. At what time are the hands of a watch together:

I. Between 3 and 4?

II. Between 6 and 7?

III. Between 9 and 10?

47. At what time are the hands of a watch at right angles:

I. Between 3 and 4?

II. Between 4 and 5?

III. Between 7 and 8?

48. At what time are the hands of a watch opposite to each other:

I. Between 1 and 2?

II. Between 4 and 5?

III. Between 8 and 9?

49. It is between 2 and 3 o'clock; but a person looking at his watch and mistaking the hour-hand for the minute hand, fancies that the time of day is 55 minutes earlier than it really is. What is the true time?

NOTE VI. It is to be observed that if a represent the number of feet in the length of a step or leap, and x the number of steps or leaps taken, then ax will represent the number of feet in the distance made.

EX. A hare takes 4 leaps to a greyhound's 3; but 2 of the greyhound's leaps are equivalent to 3 of the hare's. The hare has a start of 50 leaps. How many leaps must the greyhound take to catch the hare?

Let $3x$ = the number of leaps taken by the greyhound.
Then $4x$ = the number of leaps of the hare in the same time.
Also, let a denote the number of feet in one leap of the hare.
Then $\frac{3a}{2}$ will denote the number of feet in one leap of the greyhound.

That is, $3x \times \frac{3a}{2}$ = the whole distance,

and $(50 + 4x)\,a$ = the whole distance,

$$\therefore \frac{9ax}{2} = (50 + 4x)\,a.$$

Divide by a, $\frac{9x}{2} = 50 + 4x,$

$$9x = 100 + 8x,$$
$$x = 100,$$
$$\therefore 3x = 300.$$

Thus the greyhound must take 300 leaps.

50. A hare takes 6 leaps to a dog's 5, and 7 of the dog's leaps are equivalent to 9 of the hare's. The hare has a start of 50 of her own leaps. How many leaps will the hare take before she is caught?

51. A greyhound makes 3 leaps while a hare makes 4; but 2 of the greyhound's leaps are equivalent to 3 of the hare's. The hare has a start of 50 of the greyhound's leaps. How many leaps does each take before the hare is caught?

52. A greyhound makes two leaps while a hare makes 3; but 1 leap of the greyhound is equivalent to 2 of the hare's. The hare has a start of 80 of her own leaps. How many leaps will the hare take before she is caught?

NOTE VII. It is to be observed that if the number of units in the breadth and length of a rectangle be represented by x and $x+a$, respectively, then $x(x+a)$ will represent the number of surface units in the rectangle, the unit of surface having the same name as the linear unit in which the sides of the rectangle are expressed.

53. A rectangle whose length is 5 feet more than its breadth would have its area increased by 22 feet if its length and breadth were each made a foot more. Find its dimensions.

54. A rectangle has its length and breadth respectively 5 feet longer and 3 feet shorter than the side of the equivalent square. Find its area.

55. The length of a rectangle is an inch less than double its breadth; and when a strip 3 inches wide is cut off all round, the area is diminished by 210 inches. Find the size of the rectangle at first.

56. The length of a floor exceeds the breadth by 4 feet; if each dimension were increased by 1 foot, the area of the room would be increased by 27 square feet. Find its dimensions.

NOTE VIII. It is to be observed that if b pounds of metal lose a pounds when weighed in water, 1 pound will lose $\frac{1}{b}$ of a pounds, or $\frac{a}{b}$ of a pound.

57. A mass of tin and lead weighing 180 pounds loses 21 pounds when weighed in water; and it is known that 37 pounds of tin lose 5 pounds, and 23 pounds of lead lose 2 pounds, when weighed in water. How many pounds of tin and of lead in the mass?

58. If 19 pounds of gold lose 1 pound, and 10 pounds of silver lose 1 pound, when weighed in water, find the amount of each in a mass of gold and silver weighing 106 pounds in air and 99 pounds in water.

59. Fifteen sovereigns should weigh 77 pennyweights; but a parcel of light sovereigns, having been weighed and counted, was found to contain 9 more than was supposed from the weight; and it appeared that 21 of these coins weighed the same as 20 true sovereigns. How many were there altogether?

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60. There are two silver cups, and one cover for both. The first weighs 12 ounces, and with the cover weighs twice as much as the other without it; but the second with the cover weighs one-third more than the first without it. Find the weight of the cover.

61. A man wishes to enclose a circular piece of ground with palisades, and finds that if he sets them a foot apart he will have too few by 150; but if he sets them a yard apart he will have too many by 70. What is the circuit of the piece of ground?

62. A horse was sold at a loss for $200; but if it had been sold for $250, the gain would have been three-fourths of the loss when sold for $200. Find the value of the horse.

63. A and B shoot by turns at a target. A puts 7 bullets out of 12, and B 9 out of 12, into the centre. Between them they put in 32 bullets. How many shots did each fire?

64. A boy buys a number of apples at the rate of 5 for 2 pence. He sells half of them at 2 a penny and the rest at 3 a penny, and clears a penny by the transaction. How many does he buy?

65. A person bought a piece of land for $6750, of which he kept $\frac{4}{9}$ for himself. At the cost of $250 he made a road which took $\frac{1}{10}$ of the remainder, and then sold the rest at $12\frac{1}{2}$ cents a square yard more than double the price it cost him, thus clearing his outlay and $500 besides. How much land did he buy, and what was the cost-price per yard?

66. A boy who runs at the rate of 12 yards per second starts 20 yards behind another whose rate is $10\frac{1}{2}$ yards per second. How soon will the first boy be 10 yards ahead of the second?

67. A merchant adds yearly to his capital one-third of it, but takes from it, at the end of each year, $5000 for expenses. At the end of the third year, after deducting the last $5000, he has twice his original capital. How much had he at first?

68. A shepherd lost a number of sheep equal to one-fourth of his flock and one-fourth of a sheep; then, he lost a number equal to one-third of what he had left and one-third of a sheep; finally, he lost a number equal to one-half of what now remained and one-half a sheep, after which he had but 25 sheep left. How many had he at first?

69. A trader maintained himself for three years at an expense of $250 a year; and each year increased that part of his stock which was not so expended by one-third of it. At the end of the third year his original stock was doubled. What was his original stock?

70. A cask contains 12 gallons of wine and 18 gallons of water; another cask contains 9 gallons of wine and 3 gallons of water. How many gallons must be drawn from each cask to produce a mixture containing 7 gallons of wine and 7 gallons of water?

71. The members of a club subscribe each as many dollars as there are members. If there had been 12 more members, the subscription from each would have been \$10 less, to amount to the same sum. How many members were there?

72. A number of troops being formed into a solid square, it was found there were 60 men over; but when formed in a column with 5 men more in front than before, and 3 men less in depth, there was lacking one man to complete it. Find the number of troops.

73. An officer can form the men of his regiment into a hollow square twelve deep. The number of men in the regiment is 1296. Find the number of men in the front of the hollow square.

74. A person starts from P and walks towards Q at the rate of 3 miles an hour; 20 minutes later another person starts from Q and walks towards P at the rate of 4 miles an hour. The distance from P to Q is 20 miles. How far from P will they meet?

75. A person engaged to work a days on these conditions: for each day he worked he was to receive b cents, and for each day he was idle he was to forfeit c cents. At the end of a days he received d cents. How many days was he idle?

76. A banker has two kinds of coins: it takes a pieces of the first to make a dollar, and b pieces of the second to make a dollar. A person wishes to obtain c pieces for a dollar. How many pieces of each kind must the banker give him?

7. If B give A \$25 they will have equal sums of money; but if A give B \$22, B's money will be double that of A's. How much has each?

8. A farmer sold to one person 30 bushels of wheat and 40 bushels of barley for \$67.50; to another person he sold 50 bushels of wheat and 30 bushels of barley for \$85. What was the price of the wheat and of the barley per bushel?

9. If A give B \$5 he will then have \$6 less than B; but if he receive \$5 from B, three times his money will be \$20 more than four times B's. How much has each?

10. The cost of 12 horses and 14 cows is \$1900; the cost of 5 horses and 3 cows is \$650. What is the cost of a horse and a cow respectively?

NOTE I. A fraction of which the terms are unknown may be represented by $\frac{x}{y}$.

Ex. A certain fraction becomes equal to $\frac{1}{2}$ if 3 be added to its numerator, and equal to $\frac{2}{7}$ if 3 be added to its denominator. Determine the fraction.

Let $\frac{x}{y}$ = the required fraction.

By the conditions $\frac{x+3}{y} = \frac{1}{2}$,

and $\frac{x}{y+3} = \frac{2}{7}$.

From the solution of these equations it is found that

$$x = 6,$$
$$y = 18.$$

Therefore the fraction $= \frac{6}{18}$.

11. A certain fraction becomes equal to 2 when 7 is added to its numerator, and equal to 1 when 1 is subtracted from its denominator. Determine the fraction.

12. A certain fraction becomes equal to $\frac{1}{2}$ when 7 is added to its denominator, and equal to 2 when 13 is added to its numerator. Determine the fraction.

13. A certain fraction becomes equal to $\frac{7}{9}$ when the denominator is increased by 4, and equal to $\frac{20}{41}$ when the numerator is diminished by 15. Determine the fraction.

14. A certain fraction becomes equal to $\frac{2}{3}$ if 7 be added to the numerator, and equal to $\frac{3}{8}$ if 7 be subtracted from the denominator. Determine the fraction.

15. Find two fractions with numerators 2 and 5 respectively, whose sum is $1\frac{1}{2}$, and if their denominators are interchanged their sum is 2.

16. A fraction which is equal to $\frac{2}{3}$ is increased to $\frac{8}{11}$ when a certain number is added to both its numerator and denominator, and is diminished to $\frac{5}{9}$ when one more than the same number is subtracted from each. Determine the fraction.

NOTE II. A number consisting of *two* digits which are unknown may be represented by $10x + y$, in which x and y represent the digits of the number. Likewise, a number consisting of *three* digits which are unknown may be represented by $100x + 10y + z$, in which x, y, and z represent the digits of the number.

For example, consider any number expressed by three digits, as 364. The expression 364 means $300 + 60 + 4$; or, 100 *times* $3 + 10$ *times* $6 + 4$.

Ex. The sum of the two digits of a number is 8, and if 36 be added to the number the digits will be interchanged. What is the number?

Let x = the digit in the tens' place,

and y = the digit in the units' place.

Then $10x + y$ = the number.

By the conditions, $x + y = 8$, (1)

and $10x + y + 36 = 10y + x$. (2)

From (2), $9x - 9y = -36.$
Divide by 9, $x - y = -4.$
Add (1) and (3), $2x = 4,$
$\therefore x = 2.$
Subtract (3) from (1), $2y = 12,$
$\therefore y = 6.$

Hence, the number is 26.

17. The sum of the two digits of a number is 10, and if 54 be added to the number the digits will be interchanged. What is the number?

18. The sum of the two digits of a number is 6, and if the number be divided by the sum of the digits the quotient is 4. What is the number?

19. A certain number is expressed by two digits, of which the first is the greater. If the number be divided by the sum of its digits the quotient is 7; if the digits be interchanged, and the resulting number diminished by 12 be divided by the difference between the two digits, the quotient is 9. What is the number?

20. If a certain number be divided by the sum of its two digits the quotient is 6 and the remainder 3; if the digits be interchanged, and the resulting number be divided by the sum of the digits, the quotient is 4 and the remainder 9. What is the number?

21. If a certain number be divided by the sum of its two digits diminished by 2, the quotient is 5 and the remainder 1; if the digits be interchanged, and the resulting number be divided by the sum of the digits increased by 2, the quotient is 5 and the remainder 8. Find the number.

22. The first of the two digits of a number is, when doubled, 3 more than the second, and the number itself is less by 6 than five times the sum of the digits. What is the number?

23. A number is expressed by three digits, of which the first and last are alike. By interchanging the digits in the units' and tens' places the number is increased by 54; but if the digits in the tens' and hundreds' places are interchanged, 9 must be added to four times the resulting number to make it equal to the original number. What is the number?

24. A number is expressed by three digits. The sum of the digits is 21; the sum of the first and second exceeds the third by 3; and if 198 be added to the number, the digits in the units' and hundreds' places will be interchanged. Find the number.

25. A number is expressed by three digits. The sum of the digits is 9; the number is equal to forty-two times the sum of the first and second digits; and the third digit is twice the sum of the other two. Find the number.

26. A certain number, expressed by three digits, is equal to forty-eight times the sum of its digits. If 198 be subtracted from the number, the digits in the units' and hundreds' places will be interchanged; and the sum of the extreme digits is equal to twice the middle digit. Find the number.

NOTE III. If a boat move at the rate of x miles an hour in still water, and if it be on a stream that runs at the rate of y miles an hour, then

$x + y$ represents its rate *down* the stream,
$x - y$ represents its rate *up* the stream.

27. A waterman rows 30 miles and back in 12 hours. He finds that he can row 5 miles with the stream in the same time as 3 against it. Find the time he was rowing up and down respectively.

28. A crew, which can pull at the rate of 12 miles an hour down the stream, finds that it takes twice as long to come up the river as to go down. At what rate does the stream flow?

29. A man sculls down a stream, which runs at the rate of 4 miles an hour, for a certain distance in 1 hour and 40 minutes. In returning it takes him 4 hours and 15 minutes to arrive at a point 3 miles short of his starting-place. Find the distance he pulled down the stream and the rate of his pulling.

30. A person rows down a stream a distance of 20 miles and back again in 10 hours. He finds he can row 2 miles against the stream in the same time he can row 3 miles with it. Find the time of his rowing down and of his rowing up the stream; and also the rate of the stream.

NOTE IV. When commodities are mixed, it is to be observed that the quantity of the mixture = the quantity of the ingredients; the cost of the mixture = the cost of the ingredients.

Ex. A wine-merchant has two kinds of wine which cost 72 cents and 40 cents a quart respectively. How much of each must he take to make a mixture of 50 quarts worth 60 cents a quart?

Let x = required number of quarts worth 72 cents a quart,

and y = required number of quarts worth 40 cents a quart.

Then, $72x$ = cost in cents of the first kind,

$40y$ = cost in cents of the second kind of wine,

and 3000 = cost in cents of the mixture.

$$\therefore\ x + y = 50,$$
$$72x + 40y = 3000.$$

From which equations the values of x and y may be found.

31. A grocer mixed tea that cost him 42 cents a pound with tea that cost him 54 cents a pound. He had 30 pounds of the mixture, and by selling it at the rate of 60 cents a pound, he gained as much as 10 pounds of the cheaper tea cost him. How many pounds of each did he put into the mixture?

32. A grocer mixes tea that cost him 90 cents a pound with tea that cost him 28 cents a pound. The cost of the mixture is \$61.20. He sells the mixture at 50 cents a pound, and gains \$3.80. How many pounds of each did he put into the mixture?

33. A farmer has 28 bushels of barley worth 84 cents a bushel. With his barley he wishes to mix rye worth \$1.08 a bushel, and wheat worth \$1.44 a bushel, so that the mixture may be 100 bushels, and be worth \$1.20 a bushel. How many bushels of rye and of wheat must he take?

NOTE V. It is to be remembered that if a person can do a piece of work in x days, *the part* of the work he can do in *one* day will be represented by $\frac{1}{x}$.

Ex. A and B together can do a piece of work in 48 days; A and C together can do it in 30 days; B and C together can do it in $26\frac{2}{3}$ days. How long will it take each to do the work?

Let x = the number of days it will take A alone to do the work,
y = the number of days it will take B alone to do the work,
and z = the number of days it will take C alone to do the work.

Then, $\frac{1}{x}, \frac{1}{y}, \frac{1}{z}$, respectively, will denote the part each can do in a day,

and $\frac{1}{x}+\frac{1}{y}$ will denote the part A and B together can do in a day,

but $\frac{1}{48}$ will denote the part A and B together can do in a day.

Therefore, $\frac{1}{x}+\frac{1}{y}=\frac{1}{48}$ (1)

Likewise, $\frac{1}{x}+\frac{1}{z}=\frac{1}{30}$ (2)

and $\frac{1}{y}+\frac{1}{z}=\frac{1}{26\frac{2}{3}}=\frac{3}{80}$ (3)

Add (1), (2), and (3), $\frac{2}{x}+\frac{2}{y}+\frac{2}{z}=\frac{11}{120}$ (4)

Multiply (1) by 2, $\frac{2}{x}+\frac{2}{y}=\frac{1}{24}$ (5)

Subtract (5) from (4), $\frac{2}{z}=\frac{1}{20}$

$\therefore z=40.$

Subtract the double of (2) from (4), $\frac{2}{y}=\frac{1}{40}$

$\therefore y=80.$

Subtract the double of (3) from (4), $\frac{2}{x}=\frac{1}{60}$

$\therefore x=120.$

34. A and B together earn \$40 in 6 days; A and C together earn \$54 in 9 days; B and C together earn \$80 in 15 days. What does each earn a day?

35. A cistern has three pipes, A, B, and C. A and B will fill it in 1 hour and 10 minutes; A and C in 1 hour and 24 minutes; B and C in 2 hours and 20 minutes. How long will it take each to fill it?

36. A warehouse will hold 24 boxes and 20 bales; 6 boxes and 14 bales will fill half of it. How many of each alone will it hold?

37. Two workmen together complete some work in 20 days; but if the first had worked twice as fast, and the second half as fast, they would have finished it in 15 days. How long would it take each alone to do the work?

38. A purse holds 19 crowns and 6 guineas; 4 crowns and 5 guineas fill $\frac{17}{63}$ of it. How many of each alone will it hold?

39. A piece of work can be completed by A, B, and C together in 10 days; by A and B together in 12 days; by B and C, if B work 15 days and C 30 days. How long will it take each alone to do the work?

40. A cistern has three pipes, A, B, and C. A and B will fill it in a minutes; A and C in b minutes; B and C in c minutes. How long will it take each alone to fill it?

NOTE VI. In considering *the rate of increase or decrease* in quantities, it is usual to take 100 as a *common standard of reference*, so that the increase or decrease is calculated for every 100, and therefore called *per cent.*

It is to be observed that the representative of the number resulting after an increase has taken place is 100 + increase per cent; and after a decrease, 100 − decrease per cent.

Interest depends upon the *time* for which the money is lent, as well as upon the *rate per cent* charged; the rate per cent charged being the rate per cent on the principal for *one year*. Hence,

$$\text{Simple interest} = \frac{\text{Principal} \times \text{Rate} \times \text{Time}}{100},$$

where Time means *number of years or fraction of a year.*

$$\text{Amount} = \text{Principal} + \text{Interest}.$$

In questions relating to stocks, 100 is taken as the representative of the *stock*, the *price* represents its market value, and the *per cent* represents the *interest* which the *stock* bears. Thus, if six per cent stocks are quoted at 108, the meaning is, that the price of \$100 of the stock is \$108, and that the interest derived from \$100 of the *stock* will be $\frac{6}{100}$ of \$100, that is, \$6 a year. The rate of interest on the *money invested* will be $\frac{100}{108}$ of 6 per cent.

41. A man has \$10,000 invested. For a part of this sum he receives 5 per cent interest, and for the rest 4 per cent; the income from his 5 per cent investment is \$50 more than from his 4 per cent. How much has he in each investment?

42. A sum of money, at simple interest, amounted in 6 years to $26,000, and in 10 years to $30,000. Find the sum and the rate of interest.

43. A sum of money, at simple interest, amounted in 10 months to $26,250, and in 18 months to $27,250. Find the sum and the rate of interest.

44. A sum of money, at simple interest, amounted in m years to a dollars, and in n years to b dollars. Find the sum and the rate of interest.

45. A sum of money, at simple interest, amounted in a months to c dollars, and in b months to d dollars. Find the sum and the rate of interest.

46. A person has a certain capital invested at a certain rate per cent. Another person has $1000 more capital, and his capital invested at one per cent better than the first, and receives an income $80 greater. A third person has $1500 more capital, and his capital invested at two per cent better than the first, and receives an income $150 greater. Find the capital of each, and the rate at which it is invested.

47. A person has $12,750 to invest. He can buy three per cent bonds at 81, and five per cents at 120. Find the amount of money he must invest in each in order to have the same income from each investment.

48. A and B each invested $1500 in bonds; A in three per cents and B in four per cents. The bonds were bought at such prices that B received $5 interest more than A. After both classes of bonds rose 10 points, they sold out, and A received $50 more than B. What price was paid for each class of bonds?

49. A person invests \$10,000 in three per cent bonds, \$16,500 in three and one-half per cents, and has an income from both investments of \$1056.25. If his investments had been \$2750 more in the three per cents, and less in the three and one-half per cents, his income would have been 62½ cents greater. What price was paid for each class of bonds?

50. The sum of \$2500 was divided into two unequal parts and invested, the smaller part at two per cent more than the larger. The *rate* of interest on the larger sum was afterwards increased by 1, and that of the smaller sum diminished by 1; and thus the *interest* of the whole was increased by one-fourth of its value. If the interest of the larger sum had been so increased, and no change been made in the interest of the smaller sum, the interest of the whole would have been increased one-third of its value. Find the sums invested, and the rate per cent of each.

NOTE VII. If x represent the number of linear units in the length, and y in the width, of a rectangle, xy will represent the number of its units of surface; the surface unit having the same name as the linear unit of its sides.

51. If the sides of a rectangular field were each increased by 2 yards, the area would be increased by 220 square yards; if the length were increased and the breadth were diminished each by 5 yards, the area would be diminished by 185 square yards. What is its area?

52. If a given rectangular floor had been 3 feet longer and 2 feet broader it would have contained 64 square feet more; but if it had been 2 feet longer and 3 feet broader it would have contained 68 square feet more. Find the length and breadth of the floor.

53. In a certain rectangular garden there is a strawberry-bed whose sides are one-third of the lengths of the corresponding sides of the garden. The perimeter of the garden exceeds that of the bed by 200 yards; and if the greater side of the garden be increased by 3, and the other by 5 yards, the garden will be enlarged by 645 square yards. Find the length and breadth of the garden.

NOTE VIII. Care must be taken to express the conditions of a problem with reference to the same principal unit.

Ex. In a mile race A gives B a start of 20 yards and beats him by 30 seconds. At the second trial A gives B a start of 32 seconds and beats him by $9\frac{5}{11}$ yards. Find the rate per hour at which each runs.

Let x = number of yards A runs a second,
and y = number of yards B runs a second.
Since there are 1760 yards in a mile,

$\frac{1760}{x}$ = number of seconds it takes A to run a mile,

$\frac{1740}{y}$ and $\frac{1750\frac{5}{11}}{y}$ = number of seconds B was running in the first and second trials, respectively.

Hence, $\frac{1740}{y} - \frac{1760}{x} = 30$,

and $\frac{1750\frac{5}{11}}{y} - \frac{1760}{x} = 32$.

The solution of these equations gives $x = 5\frac{13}{15}$ and $y = 5\frac{3}{11}$.

That is, A runs $\frac{5\frac{13}{15}}{1760}$, or $\frac{1}{300}$, of a mile in one second;
and in one hour, or 3600 seconds, runs 12 miles.

Likewise, B runs $10\frac{95}{121}$ miles in one hour.

54. In a mile race A gives B a start of 100 yards and beats him by 15 seconds. In the second trial A gives B a start of 45 seconds and is beaten by 22 yards. Find the rate of each in miles per hour.

55. In a mile race A gives B a start of 44 yards and beats him by 51 seconds. In the second trial A gives B a start of 1 minute and 15 seconds and is beaten by 88 yards. Find the rate of each in miles per hour.

56. The time which an express-train takes to go 120 miles is $\frac{9}{14}$ of the time taken by an accommodation-train. The slower train loses as much time in stopping at different stations as it would take to travel 20 miles without stopping; the express-train loses only half as much time by stopping as the accommodation-train, and travels 15 miles an hour faster. Find the rate of each train in miles per hour.

57. A train moves from P towards Q, and an hour later a second train starts from Q and moves towards P at a rate of 10 miles an hour more than the first train; the trains meet half-way between P and Q. If the train from P had started an hour after the train from Q its rate must have been increased by 28 miles in order that the trains should meet at the half-way point. Find the distance from P to Q.

58. A passenger-train, after travelling an hour, meets with an accident which detains it one-half an hour; after which it proceeds at four-fifths of its usual rate, and arrives an hour and a quarter late. If the accident had happened 30 miles farther on, the train would have been only an hour late. Determine the usual rate of the train.

59. A passenger-train after travelling an hour is detained 15 minutes; after which it proceeds at three-fourths of its former rate, and arrives 24 minutes late. If the detention had taken place 5 miles farther on, the train would have been only 21 minutes late. Determine the usual rate of the train.

60. A man bought 10 oxen, 120 sheep, and 46 lambs. The cost of 3 sheep was equal to that of 5 lambs; an ox, a sheep, and a lamb together cost a number of dollars less by 57 than the whole number of animals bought; and the whole sum spent was $2341.50. Find the price of an ox, a sheep, and a lamb, respectively.

61. A farmer sold 100 head of stock, consisting of horses, oxen, and sheep, so that the whole realized $11.75 a head; while a horse, an ox, and a sheep were sold for $110, $62.50, and $7.50, respectively. Had he sold one-fourth of the number of oxen that he did, and 25 more sheep, he would have received the same sum. Find the number of horses, oxen, and sheep, respectively, which were sold.

62. A, B, and C together subscribed $100. If A's subscription had been one-tenth less, and B's one-tenth more, C's must have been increased by $2 to make up the sum; but if A's had been one-eighth more, and B's one-eighth less, C's subscription would have been $17.50. What did each subscribe?

63. A gives to B and C as much as each of them has; B gives to A and C as much as each of them then has; and C gives to A and B as much as each of them then has. In the end each of them has $6. How much had each at first?

64. A pays to B and C as much as each of them has; B pays to A and C one-half as much as each of them then has; and C pays to A and B one-third of what each of them then has. In the end A finds that he has $1.50, B $4.16⅔, C $.58⅓. How much had each at first?

(1) The sum of the squares of two consecutive numbers is 481. Find the numbers.

Let x = one number,
and $x + 1$ = the other.
Then $x^2 + (x + 1)^2 = 481$,
or $2x^2 + 2x + 1 = 481$.

The solution of which gives, $x = 15$, or -16.

The positive root 15 gives for the numbers, 15 and 16.

The negative root -16 is inapplicable to the problem, as *consecutive numbers* are understood to be integers which follow one another in the common scale, 1, 2, 3, 4.....

(2) What is the price of eggs per dozen when 2 more in a shilling's worth lowers the price 1 penny per dozen?

Let x = number of eggs for a shilling.
Then, $\frac{1}{x}$ = cost of 1 egg in shillings,
and $\frac{12}{x}$ = cost of 1 dozen in shillings.
But, if $x + 2$ = number of eggs for a shilling,
$\frac{12}{x+2}$ = cost of 1 dozen in shillings.

$$\therefore \frac{12}{x} - \frac{12}{x+2} = \frac{1}{12} \text{ (1 penny being } \tfrac{1}{12} \text{ of a shilling).}$$

The solution of which gives $x = 16$, or -18.

And, if 16 eggs cost a shilling, 1 dozen will cost $\frac{12}{16}$ of a shilling, or 9 pence.

Therefore, the price of the eggs is 9 pence per dozen.

If the problem be changed so as to read: What is the price of eggs per dozen when two *less* in a shilling's worth *raises* the price 1 penny per dozen? the algebraic statement will be

$$\frac{12}{x-2} - \frac{12}{x} = \frac{1}{12}.$$

The solution of which gives $x = 18$, or -16.

Hence, the number 18, which had a negative sign and was inapplicable in the original problem, is here the true result.

Exercise XC.

1. The sum of the squares of three consecutive numbers is 365. Find the numbers.

2. Three times the product of two consecutive numbers exceeds four times their sum by 8. Find the numbers.

3. The product of three consecutive numbers is equal to three times the middle number. Find the numbers.

4. A boy bought a number of apples for 16 cents. Had he bought 4 more for the same money he would have paid $\frac{1}{3}$ of a cent less for each apple. How many did he buy?

5. For building 108 rods of stone-wall, 6 days less would have been required if 3 rods more a day had been built. How many rods a day were built?

6. A merchant bought some pieces of silk for $900. Had he bought 3 pieces more for the same money he would have paid $15 less for each piece. How many did he buy?

7. A merchant bought some pieces of cloth for $168.75. He sold the cloth for $12 a piece and gained as much as 1 piece cost him. How much did he pay for each piece?

8. Find the price of eggs per score when 10 more in 62½ cents' worth lowers the price 31¼ cents per hundred.

9. The area of a square may be doubled by increasing its length by 6 inches and its breadth by 4 inches. Determine its side.

10. The length of a rectangular field exceeds the breadth by 1 yard, and the area is 3 acres. Determine its dimensions.

11. There are three lines of which two are each $\frac{4}{7}$ of the third, and the sum of the squares described on them is equal to a square yard. Determine the lengths of the lines in inches.

12. A grass plot 9 yards long and 6 yards broad has a path round it. The area of the path is equal to that of the plot. Determine the width of the path.

13. Find the radius of a circle the area of which would be doubled by increasing its radius by 1 inch.

14. Divide a line 20 inches long into two parts so that the rectangle contained by the whole and one part may be equal to the square on the other part.

15. A can do some work in 9 hours less time than B can do it, and together they can do it in 20 hours. How long will it take each alone to do it?

16. A vessel which has two pipes can be filled in 2 hours less time by one than by the other, and by both together in 2 hours 55 minutes. How long will it take each pipe alone to fill the vessel?

17. A vessel which has two pipes can be filled in 2 hours less time by one than by the other, and by both together in 1 hour 52 minutes 30 seconds. How long will it take each pipe alone to fill the vessel?

18. An iron bar weighs 36 pounds. If it had been 1 foot longer each foot would have weighed $\frac{1}{2}$ a pound less. Find the length and the weight per foot.

19. A number is expressed by two digits, one of which is the square of the other, and when 54 is added its digits are interchanged. Find the number.

20. Divide 35 into two parts so that the sum of the two fractions formed by dividing each part by the other may be $2\frac{1}{12}$.

21. A boat's crew row $3\frac{1}{2}$ miles down a river and back again in 1 hour 40 minutes. If the current of the river is 2 miles per hour, determine their rate of rowing in still water.

22. A detachment from an army was marching in regular column with 5 men more in depth than in front. On approaching the enemy the front was increased by 845 men, and the whole was thus drawn up in 5 lines. Find the number of men.

23. A jockey sold a horse for \$144, and gained as much per cent as the horse cost. What did the horse cost?

24. A merchant expended a certain sum of money in goods, which he sold again for \$24, and lost as much per cent as the goods cost him. How much did he pay for the goods?

25. A broker bought a number of bank shares (\$100 each), when they were at a certain per cent *discount*, for \$7500; and afterwards when they were at the same per cent *premium*, sold all but 60 for \$5000. How many shares did he buy, and at what price?

26. The thickness of a rectangular solid is $\frac{2}{3}$ of its width, and its length is equal to the sum of its width and thickness; also, the number of cubic yards in its volume added to the number of linear yards in its edges is $\frac{5}{6}$ of the number of square yards in its surface. Determine its dimensions.

27. If a carriage-wheel $16\frac{1}{2}$ feet round took 1 second more to revolve, the rate of the carriage per hour would be $1\frac{7}{8}$ miles less. At what rate is the carriage travelling?

CHAPTER XV.

Simultaneous Quadratic Equations.

237. Quadratic equations involving *two* unknown quantities require different methods for their solution, according to the *form* of the equations.

238. Case I. When from one of the equations the value of one of the unknown quantities can be found in terms of the other, and this value *substituted* in the other equation.

Ex. Solve: $\left.\begin{aligned} 3x^2 - 2xy &= 5 \\ x - y &= 2 \end{aligned}\right\}$ (1) (2)

Transpose x in (2), $y = x - 2$.
Substitute in (1), $3x^2 - 2x(x-2) = 5$.
The solution of which gives $x = 1$ or -5.
$\therefore y = -1$ or -7.

Special methods often give more elegant solutions of examples than the *general* method by *substitution*.

I. *When equations have the form*, $x \pm y = a$, *and* $xy = b$; $x^2 \pm y^2 = a$, *and* $xy = b$; *or*, $x \pm y = a$, *and* $x^2 + y^2 = b$.

(1) Solve: $\left.\begin{aligned} x + y &= 40 \\ xy &= 300 \end{aligned}\right\}$ (1) (2)

Square (1), $x^2 + 2xy + y^2 = 1600$. (3)
Multiply (2) by 4, $4xy = 1200$. (4)
Subtract (4) from (3), $x^2 - 2xy + y^2 = 400$.
Extract root of each side. $x - y = \pm 20$. (6)
Add (1) and (6), $2x = 60$ or 20,
$\therefore x = 30$ or 10.
Subtract (6) from (1), $2y = 20$ or 60,
$\therefore y = 10$ or 30.

(2) Solve: $\left.\begin{aligned} x-y&=4 \\ x^2+y^2&=40 \end{aligned}\right\}$ (1) (2)

Square (1), $x^2-2xy+y^2=16.$ (3)
Subtract (2) from (3), $-2xy=-24.$ (4)
Subtract (4) from (2), $x^2+2xy+y^2=64.$
Extract the root, $x+y=\pm 8.$ (5)
By combining (5) and (1), $x=6$ or $-2.$
$y=2$ or $-6.$

(3) Solve: $\left.\begin{aligned} \frac{1}{x}+\frac{1}{y}&=\frac{9}{20} \\ \frac{1}{x^2}+\frac{1}{y^2}&=\frac{41}{400} \end{aligned}\right\}$ (1) (2)

Square (1), $\frac{1}{x^2}+\frac{2}{xy}+\frac{1}{y^2}=\frac{81}{400}.$ (3)
Subtract (2) from (3), $\frac{2}{xy}=\frac{40}{400}.$ (4)
Subtract (4) from (2), $\frac{1}{x^2}-\frac{2}{xy}+\frac{1}{y^2}=\frac{1}{400}.$
Extract the root, $\frac{1}{x}-\frac{1}{y}=\pm\frac{1}{20}.$ (5)
By combining (1) and (5), $x=4$ or $5.$
$y=5$ or $4.$

II. *When one equation may be simplified by dividing it by the other.*

(4) Solve: $\left.\begin{aligned} x^2+y^2&=91 \\ x+y&=7 \end{aligned}\right\}$ (1) (2)

Divide (1) by (2), $x^2-xy+y^2=13.$ (3)
Square (2), $x^2+2xy+y^2=49.$ (4)
Subtract (3) from (4), $3xy=36.$
Divide by -3, $-xy=-12.$ (5)
Add (5) and (3), $x^2-2xy+y^2=1.$
Extract the root, $x-y=\pm 1.$ (6)
By combining (6) and (2), $x=4$ or $3.$
$y=3$ or $4.$

Exercise XCI.

Solve:

1. $x+y=13$, $xy=36$

2. $x+y=29$, $xy=100$

3. $x-y=19$, $xy=66$

4. $x-y=45$, $xy=250$

5. $x-y=10$, $x^2+y^2=178$

6. $x-y=14$, $x^2+y^2=436$

7. $x+y=12$, $x^2+y^2=104$

8. $\frac{1}{x}+\frac{1}{y}=\frac{3}{4}$, $\frac{1}{x^2}+\frac{1}{y^2}=\frac{5}{16}$

9. $\frac{1}{x}+\frac{1}{y}=5$, $\frac{1}{x^2}+\frac{1}{y^2}=13$

10. $7x^2-8xy=159$, $5x+2y=7$

11. $x+y=49$, $x^2+y^2=1681$

12. $x^3+y^3=341$, $x+y=11$

13. $x^3+y^3=1008$, $x+y=12$

14. $x^3-y^3=98$, $x-y=2$

15. $x^3-y^3=279$, $x-y=3$

16. $x-3y=1$, $xy+y^2=5$

17. $4y=5x+1$, $2xy=33-x^2$

18. $\frac{1}{x}-\frac{1}{y}=3$, $\frac{1}{x^2}-\frac{1}{y^2}=21$

19. $\frac{1}{x}-\frac{1}{y}=2\frac{1}{2}$, $\frac{1}{x^2}-\frac{1}{y^2}=8\frac{1}{4}$

20. $x^2-2xy-y^2=1$, $x+y=2$

239. CASE II. When each of the two equations is *homogeneous* and of the *second degree.*

Ex. Solve: $\left.\begin{aligned} 2y^2-4xy+3x^2&=17 \\ y^2-x^2&=16 \end{aligned}\right\}$ (1) (2)

Let $y=vx$, and substitute vx for y in both equations.

From (1), $2v^2x^2-4vx^2+3x^2=17$.

$$\therefore x^2=\frac{17}{2v^2-4v+3}.$$

From (2), $v^2x^2-x^2=16$,

$$\therefore x^2=\frac{16}{v^2-1}.$$

Equate the values of x^2,

$$\frac{17}{2v^2-4v+3}=\frac{16}{v^2-1},$$

$$32v^2-64v+48=17v^2-17,$$

$$15v^2-64v=-65.$$

The solution gives, $v=\frac{5}{3}$ or $\frac{13}{5}$.

Substitute the value of v in $x^2=\frac{16}{v^2-1}$,

then, $x^2=9$ or $\frac{25}{9}$,

$$\therefore x=\pm 3 \text{ or } \pm\frac{5}{3},$$

and $y=vx=\pm 5$ or $\pm\frac{13}{3}$.

EXERCISE XCII.

Solve:

1. $\left.\begin{aligned} x^2+xy+2y^2&=74 \\ 2x^2+2xy+y^2&=73 \end{aligned}\right\}$

2. $\left.\begin{aligned} x^2+xy+4y^2&=6 \\ 3x^2+8y^2&=14 \end{aligned}\right\}$

3. $\left.\begin{aligned} x^2-xy+y^2&=21 \\ y^2-2xy&=-15 \end{aligned}\right\}$

4. $\left.\begin{aligned} x^2-4y^2-9&=0 \\ xy+2y^2-3&=0 \end{aligned}\right\}$

5. $\left.\begin{aligned} x^2-xy-35&=0 \\ xy+y^2-18&=0 \end{aligned}\right\}$

6. $\left.\begin{aligned} x^2+xy+2y^2&=44 \\ 2x^2-xy+y^2&=16 \end{aligned}\right\}$

7. $x^2+xy-15=0$, $xy-y^2-2=0$

8. $x^2-xy+y^2=7$, $3x^2+13xy+8y^2=162$

9. $2x^2+3xy+y^2=70$, $6x^2+xy-y^2=50$

10. $x^2-xy-y^2=5$, $2x^2+3xy+y^2=28$

240. CASE III. When the two equations are *symmetrical* with respect to x and y; that is, when they have x and y similarly involved in them.

Thus, the expressions $2x^3+3x^2y^2+2y^3$, $2xy-3x-3y+1$, $x^4-3x^2y-3xy^2+y^4$ are symmetrical expressions.

(1) Solve: $x^3+y^3=18xy$ (1), $x+y=12$ (2)

Put $u+v$ for x, and $u-v$ for y, in (1) and (2).

(1) becomes $(u+v)^3+(u-v)^3=18(u+v)(u-v)$,

or $u^3+3uv^2=9(u^3-v^3)$. (3)

(2) becomes $(u+v)+(u-v)=12$,

or $2u=12$,

$\therefore u=6$.

Substitute 6 for u in (3).

(3) becomes $216+18v^2=9(36-v^2)$,

whence, $v^2=4$,

$\therefore v=\pm 2$,

$\therefore x=u+v=6\pm 2=8$ or 4,

and $y=u-v=6\mp 2=4$ or 8.

(2) Solve: $x+y=8$ (1), $x^4+y^4=706$ (2)

Put $u+v$ for x, and $u-v$ for y, in (1) and (2).

(1) becomes $(u+v)+(u-v)=8$,

$\therefore u=4$.

(2) becomes $u^4+6u^2v^2+v^4=353$. (3)

Substitute 4 for u in (3),

$256+96v^2+v^4=353$,

or, $v^4+96v^2=97$. (4)

The solution of (4) gives $v=\pm 1$ or $\pm\sqrt{-97}$.

Taking the possible values of v, $x=5$ or 3, and $y=3$ or 5.

Exercise XCIII.

Solve:

1. $\left.\begin{aligned} 4xy &= 96 - x^2y^2 \\ x + y &= 6 \end{aligned}\right\}$

2. $\left.\begin{aligned} x^2 + y^2 &= 18 - x - y \\ xy &= 6 \end{aligned}\right\}$

3. $\left.\begin{aligned} 2(x^2 + y^2) &= 5xy \\ 4(x - y) &= xy \end{aligned}\right\}$

4. $\left.\begin{aligned} 4(x + y) &= 3xy \\ x + y + x^2 + y^2 &= 26 \end{aligned}\right\}$

5. $\left.\begin{aligned} 4x^2 + xy + 4y^2 &= 58 \\ 5x^2 + 5y^2 &= 65 \end{aligned}\right\}$

6. $\left.\begin{aligned} xy(x + y) &= 30 \\ x^3 + y^3 &= 35 \end{aligned}\right\}$

241. The preceding cases are *general methods* for the solution of equations which belong to the kinds referred to; often, however, in the solution of these and other kinds of simultaneous equations involving quadratics, a little ingenuity will suggest some step by which the roots may easily be found.

Exercise XCIV.

Solve:

1. $\left.\begin{aligned} x - y &= 7 \\ x^2 + xy + y^2 &= 13 \end{aligned}\right\}$

2. $\left.\begin{aligned} x^2 + xy &= 35 \\ xy - y^2 &= 6 \end{aligned}\right\}$

3. $\left.\begin{aligned} xy - 12 &= 0 \\ x - 2y &= 5 \end{aligned}\right\}$

4. $\left.\begin{aligned} xy - 7 &= 0 \\ x^2 + y^2 &= 50 \end{aligned}\right\}$

5. $\left.\begin{aligned} 2x - 5y &= 9 \\ x^2 - xy + y^2 &= 7 \end{aligned}\right\}$

6. $\left.\begin{aligned} x - y &= 9 \\ xy + 8 &= 0 \end{aligned}\right\}$

7. $\left.\begin{aligned} 5x - 7y &= 0 \\ 5x^2 - \frac{13xy}{4} &= 4 - 7y^2 \end{aligned}\right\}$

8. $\left.\begin{aligned} x - y &= 1 \\ x^2 + y^2 &= 8\tfrac{1}{2} \end{aligned}\right\}$

9. $\left.\begin{aligned} x^2 + 4xy &= 3 \\ 4xy + y^2 &= 2\tfrac{1}{4} \end{aligned}\right\}$

10. $\left.\begin{aligned} x^2 - xy + y^2 &= 48 \\ x - y - 8 &= 0 \end{aligned}\right\}$

11. $\left.\begin{aligned} x^2 + 3xy + y^2 &= 1 \\ 3x^2 + xy + 3y^2 &= 13 \end{aligned}\right\}$

12. $\left.\begin{aligned} x^2 - 2xy + 3y^2 &= 1\tfrac{2}{9} \\ x^2 + xy - y^2 &= \tfrac{1}{9}. \end{aligned}\right\}$

13. $\left.\begin{aligned} x + y &= a \\ 4xy - a^2 &= -4b^2 \end{aligned}\right\}$

14. $\left.\begin{aligned} x - y &= 1 \\ \frac{x}{y} + \frac{y}{x} &= 2\tfrac{1}{6} \end{aligned}\right\}$

15. $\left.\begin{aligned} x^2+9xy&=340\\ 7xy-y^2&=171\end{aligned}\right\}$

16. $\left.\begin{aligned} x+y&=6\\ x^3+y^3&=72\end{aligned}\right\}$

17. $\left.\begin{aligned} 3xy+2x+y&=485\\ 3x-2y&=0\end{aligned}\right\}$

18. $\left.\begin{aligned} x-y&=1\\ x^3-y^3&=19\end{aligned}\right\}$

19. $\left.\begin{aligned} x^3+y^3&=2728\\ x^2-xy+y^2&=124\end{aligned}\right\}$

20. $\left.\begin{aligned} x+y&=a\\ x^2+y^2&=b^2\end{aligned}\right\}$

21. $\left.\begin{aligned} x^2-y^2&=0\\ 3x^2-4xy+5y^2&=9\end{aligned}\right\}$

22. $\left.\begin{aligned} \frac{x+y}{x-y}+\frac{x-y}{x+y}&=\frac{10}{3}\\ x^2+y^2&=45\end{aligned}\right\}$

23. $\left.\begin{aligned} \frac{1}{x}+\frac{1}{y}&=5\\ \frac{1}{x+1}+\frac{1}{y+1}&=\frac{17}{12}\end{aligned}\right\}$

24. $\left.\begin{aligned} x^2-xy+y^2&=7\\ x^4+x^2y^2+y^4&=133\end{aligned}\right\}$

25. $\left.\begin{aligned} x+y&=4\\ x^4+y^4&=82\end{aligned}\right\}$

26. $\left.\begin{aligned} x^3-y^3&=a^3\\ x-y&=a\end{aligned}\right\}$

27. $\left.\begin{aligned} x^2-xy&=a^2+b^2\\ xy-y^2&=2ab\end{aligned}\right\}$

28. $\left.\begin{aligned} x^2-y^2&=4ab\\ xy&=a^2-b^2\end{aligned}\right\}$

29. $\left.\begin{aligned} xy&=0\\ x^2+y^2&=16\end{aligned}\right\}$

30. $\left.\begin{aligned} x^2+xy+y^2&=37\\ x^4+x^2y^2+y^4&=481\end{aligned}\right\}$

31. $\left.\begin{aligned} x^2&=ax+by\\ y^2&=ay+bx\end{aligned}\right\}$

32. $\left.\begin{aligned} x-y-2&=0\\ 15(x^2-y^2)&=16xy\end{aligned}\right\}$

33. $\left.\begin{aligned} \frac{x+y}{x-y}+\frac{x-y}{x+y}&=\frac{89}{40}\\ 6x&=20y+9\end{aligned}\right\}$

34. $\left.\begin{aligned} \frac{x}{a}+\frac{y}{b}&=1\\ \frac{a}{x}+\frac{b}{y}&=4\end{aligned}\right\}$

35. $\left.\begin{aligned} x^2+y^2&=7+xy\\ x^3+y^3&=6xy-1\end{aligned}\right\}$

36. $\left.\begin{aligned} x^5-y^5&=3093\\ x-y&=3\end{aligned}\right\}$

37. $\left.\begin{aligned} \tfrac{3}{5}(x-1)-\tfrac{2}{3}(x+1)(y-1)&=-11\\ \tfrac{1}{3}(y+2)&=\tfrac{1}{4}(x+2)\end{aligned}\right\}$

38. $\left.\begin{aligned} 10x^2+15xy&=3ab-2a^2\\ 10y^2+15xy&=3ab-2b^2\end{aligned}\right\}$

EXERCISE XCV.

1. If the length and breadth of a rectangle were each increased by 1, the area would be 48; if they were each diminished by 1, the area would be 24. Find the length and breadth.

2. The sum of the squares of the two digits of a number is 25, and the product of the digits is 12. Find the number.

3. The sum, the product, and the difference of the squares, of two numbers are all equal. Find the numbers.

NOTE. Represent the numbers by $x+y$ and $x-y$, respectively.

4. The difference of two numbers is $\frac{2}{5}$ of the greater, and the sum of their squares is 356. What are the numbers?

5. The numerator and denominator of one fraction are each greater by 1 than those of another, and the sum of the two fractions is $1\frac{5}{12}$; if the numerators were interchanged the sum of the fractions would be $1\frac{1}{2}$. Find the fractions.

6. A man starts from the foot of a mountain to walk to its summit. His rate of walking during the second half of the distance is $\frac{1}{2}$ mile per hour less than his rate during the first half, and he reaches the summit in $5\frac{1}{2}$ hours. He descends in $3\frac{3}{4}$ hours, by walking 1 mile more per hour than during the first half of the ascent. Find the distance to the top and the rates of walking.

NOTE. Let $2x$ = the distance, and y miles per hour = the rate at first.

Then $\frac{x}{y}+\frac{x}{y-\frac{1}{2}}=5\frac{1}{2}$ hours, and $\frac{2x}{y+1}=3\frac{3}{4}$ hours.

7. The sum of two numbers which are formed by the same two digits in reverse order is $\frac{5}{11}\frac{5}{8}$ of their difference; and the difference of the squares of the numbers is 3960. Determine the numbers.

8. The hypotenuse of a right triangle is 20, and the area of the triangle is 96. Determine the sides.

NOTE. The square on the hypotenuse = sum of the squares on the sides; and the area of a right triangle = $\frac{1}{2}$ product of sides.

9. Two boys run in opposite directions round a rectangular field the area of which is an acre; they start from one corner and meet 13 yards from the opposite corner; and the rate of one is $\frac{5}{6}$ of the rate of the other. Determine the dimensions of the field.

10. A, in running a race with B, to a post and back, met him 10 yards from the post. To make it a dead heat, B must have increased his rate from this point $41\frac{3}{7}$ yards per minute; and if, without changing his pace, he had turned back on meeting A, he would have come 4 seconds after him. How far was it to the post?

11. The fore wheel of a carriage turns in a mile 132 times more than the hind wheel; but if the circumferences were each increased by 2 feet, it would turn only 88 times more. Find the circumference of each.

12. A person has $6500, which he divides into two parts and loans at *different rates* of interest, so that the two parts produce *equal* returns. If the first part had been loaned at the second rate of interest, it would have produced $180; and if the second part had been loaned at the first rate of interest, it would have produced $245. Find the rates of interest.

CHAPTER XIX.

LOGARITHMS.

292. In the common system of notation the expression of numbers is founded on their relation to *ten*.

Thus, 3854 indicates that this number contains 10^3 three times, 10^2 eight times, 10 five times, and four units.

293. In this system a number is represented by a series of *different* powers of 10, the exponent of each power being *integral*. But, by employing *fractional* exponents, any number may be represented (approximately) as a *single* power of 10.

294. When numbers are referred in this way to 10, the **exponents of the powers** corresponding to them are called their **logarithms** to the base 10.

For brevity the word "logarithm" is written log.

From § 255 it appears that:

$$10^0 = 1, \qquad 10^{-1} \left(= \tfrac{1}{10}\right) = .1,$$
$$10^1 = 10, \qquad 10^{-2} \left(= \tfrac{1}{100}\right) = .01,$$
$$10^2 = 100, \qquad 10^{-3} \left(= \tfrac{1}{1000}\right) = .001,$$

and so on. Hence,

$$\log 1 = 0, \qquad \log .1 = -1,$$
$$\log 10 = 1, \qquad \log .01 = -2,$$
$$\log 100 = 2, \qquad \log .001 = -3,$$

and so on.

It is evident that the logarithms of all numbers between

1	and 10	will be	0 + a fraction,
10	and 100	will be	1 + a fraction,
100	and 1000	will be	2 + a fraction,
1	and .1	will be	− 1 + a fraction,
.1	and .01	will be	− 2 + a fraction,
.01	and .001	will be	− 3 + a fraction.

295. The fractional part of a logarithm cannot be expressed *exactly* either by common or by decimal fractions; but decimals may be obtained for these fractional parts, true to as many places as may be desired.

If, for instance, the logarithm of 2 be required; log 2 may be supposed to be $\frac{1}{3}$.

Then $10^{\frac{1}{3}} = 2$; or, by raising both sides to the *third* power, $10 = 8$, a result which shows that $\frac{1}{3}$ is too large.

Suppose, then, $\log 2 = \frac{3}{10}$. Then $10^{\frac{3}{10}} = 2$, or by raising both sides to the *tenth* power, $10^3 = 2^{10}$. That is, $1000 = 1024$, a result which shows that $\frac{3}{10}$ is too small.

Since $\frac{1}{3}$ is too large and $\frac{3}{10}$ too small, log 2 lies between $\frac{1}{3}$ and $\frac{3}{10}$; that is, between .33333 and .30000.

In supposing log 2 to be $\frac{1}{3}$, the error of the result is $\frac{10-3}{10} = \frac{2}{10} = .2$. In supposing log 2 to be $\frac{3}{10}$, the error of the result is $\frac{1000-1024}{1000} = \frac{-24}{1000} = -.024$; log 2, therefore, is nearer to $\frac{3}{10}$ than to $\frac{1}{3}$.

The difference between the errors is $.2 - (-.024) = .224$, and the difference between the supposed logarithms is $.33333 - .3 = .03333$.

The last error, therefore, in the supposed logarithm may be considered to be approximately $\frac{24}{224}$ of $.03333 = .0035$ nearly, and this added to .3000 gives .3035, a result a little too large.

By shorter methods of higher mathematics, the logarithm of 2 is known to be 0.3010300, true to the seventh place.

296. The logarithm of a number consists of two parts, an integral part and a fractional part.

Thus, $\log 2 = 0.30103$, in which the integral part is 0, and the fractional part is .30103; $\log 20 = 1.30103$, in which the integral part is 1, and the fractional part is .30103.

297. The integral part of a logarithm is called the **characteristic**; and the fractional part is called the **mantissa.**

298. The mantissa is always made *positive.* Hence, in the case of numbers less than 1 whose logarithms are *negative,* the logarithm is made to consist of a *negative* characteristic and a *positive* mantissa.

299. When a logarithm consists of a *negative* characteristic and a *positive* mantissa, it is usual to write the minus sign *over* the characteristic, or else to add 10 to the characteristic and to indicate the subtraction of 10 from the resulting logarithm.

Thus, $\log .2 = \bar{1}.30103$, and this may be written $9.30103 - 10$.

300. *The characteristic of a logarithm of an integral number, or of a mixed number, is one less than the number of integral digits.*

Thus, from § 294, $\log 1 = 0$, $\log 10 = 1$, $\log 100 = 2$. Hence, the logarithms of all numbers from 1 to 10 (that is, of all numbers consisting of *one* integral digit), will have 0 for characteristic; and the logarithms of all numbers from 10 to 100 (that is, of all numbers consisting of *two* integral digits), will have 1 for characteristic; and so on, the characteristic increasing by 1 for each increase in the number of digits, and therefore always being 1 less than that number.

301. *The characteristic of a logarithm of a decimal fraction is negative, and is equal to the number of the place occupied by the first significant figure of the decimal.*

Thus, from § 294, $\log .1 = -1$, $\log .01 = -2$, $\log .001 = -3$. Hence, the logarithms of all numbers from .1 to 1 will have -1 for a characteristic (the mantissa being *plus*); the logarithms of all numbers from .01 to .1 will have -2 for a characteristic; the logarithms of all numbers from .01 to .001 will have -3 for a characteristic; and so on, the characteristic always being *negative and equal to the number of the place occupied by the first significant figure of the decimal.*

302. *The mantissa of a logarithm of any integral number or decimal fraction depends only upon the digits of the number, and is unchanged so long as the sequence of the digits remains the same.*

For, changing the position of the decimal point in a number is equivalent to multiplying or dividing the number by a power of 10. Its logarithm, therefore, will be increased or diminished by the *exponent* of that power of 10; and, since this exponent is *integral*, the *mantissa* of the logarithm will be unaffected.

Thus, if $27196 = 10^{4.4345}$,
then $2719.6 = 10^{3.4345}$,
$27.196 = 10^{1.4345}$,
$2.7196 = 10^{0.4345}$,
$.27196 = 10^{9.4345-10}$,
$.0027196 = 10^{7.4345-10}$.

303. The advantage of using the number **10** as the base of a system of logarithms consists in the fact that the **mantissa** depends only on the **sequence of digits**, and the **characteristic** on the **position of the decimal point.**

304. As logarithms are simply exponents (§ 294), therefore,

The logarithm of a product is the sum of the logarithms of the factors.

$$\begin{aligned}
\text{Thus, } \log 20 = \log (2 \times 10) &= \log 2 + \log 10 \\
&= 0.3010 + 1.0000 = 1.3010; \\
\log 2000 = \log (2 \times 1000) &= \log 2 + \log 1000, \\
&= 0.3010 + 3.0000 = 3.3010; \\
\log .2 = \log (2 \times .1) &= \log 2 + \log .1, \\
&= 0.3010 + 9.0000 - 10 = 9.3010 - 10; \\
\log .02 = \log (2 \times .01) &= \log 2 + \log .01, \\
&= 0.3010 + 8.0000 - 10 = 8.3010 - 10.
\end{aligned}$$

Exercise CIX.

Given: $\log 2 = 0.3010$; $\log 3 = 0.4771$; $\log 5 = 0.6990$; $\log 7 = 0.8451$.

Find the logarithms of the following numbers by resolv-

ing the numbers into factors, and taking the sum of the logarithms of the factors:

1. log 6.	**9.** log 25.	**17.** log .021.	**25.** log 2.1.
2. log 15.	**10.** log 30.	**18.** log .35.	**26.** log 16.
3. log 21.	**11.** log 42.	**19.** log .0035.	**27.** log .056.
4. log 14.	**12.** log 420.	**20.** log .004.	**28.** log .63.
5. log 35.	**13.** log 12.	**21.** log .05.	**29.** log 1.75.
6. log 9.	**14.** log 60.	**22.** log 12.5.	**30.** log 105.
7. log 8.	**15.** log 75.	**23.** log 1.25.	**31.** log .0105.
8. log 49.	**16.** log 7.5.	**24.** log 37.5.	**32.** log 1.05.

305. As logarithms are simply exponents (§ 294), therefore,

The logarithm of a power of a number is equal to the logarithm of the number multiplied by the exponent of the power.

Thus, $\log 5^7 = 7 \times \log 5 = 7 \times 0.6990 = 4.8930.$
$\log 3^{11} = 11 \times \log 3 = 11 \times 0.4771 = 5.2481.$

306. As logarithms are simply exponents (§ 294), therefore, when roots are expressed by fractional indices,

The logarithm of a root of a number is equal to the logarithm of the number multiplied by the index of the root.

Thus, $\log 2^{\frac{1}{4}} = \frac{1}{4}$ of $\log 2 = \frac{1}{4} \times 0.3010 = 0.0753.$
$\log .002^{\frac{1}{3}} = \frac{1}{3}$ of $(7.3010 - 10).$

The expression $\frac{1}{3}$ of $(7.3010 - 10)$
may be put in the form of $\frac{1}{3}$ of $(27.3010 - 30)$ which $= 9.1003 - 10$; for, since $20 - 20 = 0$, the addition of 20 to the 7, and of -20 to the -10, produces no change in the *value* of the logarithm.

307. *In simplifying the logarithm of a root the equal positive and negative numbers to be added to the logarithm must be such that the resulting negative number, when divided by the index of the root, shall give a quotient of* -10.

Exercise CX.

Given: log 2 = 0.3010; log 3 = 0.4771; log 5 = 0.6990; log 7 = 0.8451.

Find logarithms of the following:

1. 2^3.	6. 5^5.	11. $5^{\frac{1}{5}}$.	16. $7^{\frac{2}{3}}$.	21. $5^{\frac{7}{4}}$.
2. 5^2.	7. $2^{\frac{1}{3}}$.	12. $7^{\frac{1}{11}}$.	17. $5^{\frac{5}{8}}$.	22. $2^{\frac{11}{7}}$.
3. 7^4.	8. $5^{\frac{1}{2}}$.	13. $2^{\frac{3}{4}}$.	18. $3^{\frac{9}{11}}$.	23. $5^{\frac{3}{4}}$.
4. 3^8.	9. $3^{\frac{1}{3}}$.	14. $5^{\frac{2}{3}}$.	19. $7^{\frac{7}{4}}$.	24. $7^{\frac{11}{7}}$.
5. 7^3.	10. $7^{\frac{1}{5}}$.	15. $3^{\frac{5}{7}}$.	20. $3^{\frac{4}{3}}$.	25. $21^{\frac{7}{8}}$.

308. Since logarithms are simply exponents (§ 294), therefore,

The logarithm of a quotient is the logarithm of the dividend minus the logarithm of the divisor.

Thus, $\log \frac{3}{2} = \log 3 - \log 2 = 0.4771 - 0.3010 = 0.1761.$

$\log \frac{2}{3} = \log 2 - \log 3 = 0.3010 - 0.4771 = -0.1761.$

To avoid the negative logarithm -0.1761, we subtract the *entire* logarithm 0.1761 from 10, and then indicate the subtraction of 10 from the result.

Thus, $-0.1761 = 9.8239 - 10.$

Hence, $\log \frac{2}{3} = 9.8239 - 10.$

309. The remainder obtained by subtracting the logarithm of a number from 10 is called the **cologarithm** of the number, or **arithmetical complement** of the logarithm of the number.

Cologarithm is usually denoted by colog, and is most easily found by *beginning with the characteristic of the logarithm and subtracting each figure from* 9 *down to the last significant figure, and subtracting that figure from* 10.

Thus, log 7 = 0.8451; and colog 7 = 9.1549. Colog 7 is readily found by subtracting, mentally, 0 from 9, 8 from 9, 4 from 9, 5 from 9, 1 from 10, and writing the resulting figure at each step.

310. Since $\operatorname{colog} 7 = 9.1549,$

and $\log \frac{1}{7} = \log 1 - \log 7 = 0 - 0.8451 = 9.1549 - 10,$

it is evident that,

If 10 *be subtracted from the cologarithm of a number, the result is the logarithm of the reciprocal of that number.*

311. Since $\log \frac{7}{5} = \log 7 - \log 5,$

$= 0.8451 - 0.6990 = 0.1461,$

and $\log 7 + \operatorname{colog} 5 - 10 = 0.8451 + 9.3010 - 10,$

$= 0.1461,$

it is evident that,

The addition of a cologarithm − 10 *is equivalent to the* **subtraction of a logarithm.**

The steps that lead to this result are:

$\frac{7}{5} = 7 \times \frac{1}{5},$

therefore, $\log \frac{7}{5} = \log (7 \times \frac{1}{5}) = \log 7 + \log \frac{1}{5}.$ § 304.

But $\log \frac{1}{5} = \operatorname{colog} 5 - 10.$ § 309.

Hence, $\log \frac{7}{5} = \log 7 + \operatorname{colog} 5 - 10.$

Therefore,

312. *The logarithm of a quotient may be found by adding together the logarithm of the dividend and the cologarithm of the divisor, and subtracting* 10 *from the result.*

In finding a cologarithm when the *characteristic* of the logarithm is a *negative* number, it must be observed that the *subtraction* of a *negative* number is equivalent to the *addition* of an *equal positive* number.

Thus, $\log \frac{5}{.002} = \log 5 + \operatorname{colog} .002 - 10,$

$= 0.6990 + 12.6990 - 10,$

$= 3.3980.$

Here $\log .002 = \overline{3}.3010,$ and in subtracting − 3 from 9 the result is the same as adding + 3 to 9.

Again, $\log \frac{2}{.07} = \log 2 + \operatorname{colog} .07 - 10,$

$= 0.3010 + 11.1549 - 10,$

$= 1.4559.$

Also, $\log \frac{.07}{2^3} = 8.8451 - 10 + 9.0970 - 10,$

$= 17.9421 - 20,$

$= 7.9421 - 10.$

Here, $\log 2^3 = 3 \log 2 = 3 \times 0.3010 = 0.9030.$

Hence, $\operatorname{colog} 2^3 = 10 - 0.9030 = 9.0970.$

Exercise CXI.

Given: $\log 2 = 0.3010$; $\log 3 = 0.4771$; $\log 5 = 0.6990$; $\log 7 = 0.8451$.

Find logarithms for the following quotients:

1. $\frac{2}{5}$.	7. $\frac{5}{3}$.	13. $\frac{.05}{3}$.	19. $\frac{.05}{.003}$.	25. $\frac{.02^2}{3^3}$.
2. $\frac{2}{7}$.	8. $\frac{5}{2}$.	14. $\frac{.005}{2}$.	20. $\frac{.007}{.02}$.	26. $\frac{3^3}{.02^2}$.
3. $\frac{3}{5}$.	9. $\frac{7}{3}$.	15. $\frac{.07}{5}$.	21. $\frac{.02}{.007}$.	27. $\frac{7^2}{.02^2}$.
4. $\frac{3}{7}$.	10. $\frac{7}{2}$.	16. $\frac{5}{.07}$.	22. $\frac{005}{.07}$.	28. $\frac{.07^2}{.003^3}$.
5. $\frac{5}{7}$.	11. $\frac{3}{2}$.	17. $\frac{3}{.007}$.	23. $\frac{.03}{7}$.	29. $\frac{.005^3}{7^3}$.
6. $\frac{7}{5}$.	12. $\frac{7}{.5}$.	18. $\frac{.003}{7}$.	24. $\frac{.0007}{.2}$.	30. $\frac{7^3}{.005^2}$.

313. A table of *four-place* logarithms is here given, which contains logarithms of all numbers under 1000, *the decimal point and characteristic being omitted.* The logarithms of single digits 1, 8, etc., will be found at 10, 80, etc.

Tables containing logarithms of more places can be procured, but this table will serve for many practical uses, and will enable the student to use tables of six-place, seven-place, and ten-place logarithms, in work that requires greater accuracy.

314. In working with a four-place table, the numbers corresponding to the logarithms, that is, the *antilogarithms*, as they are called, may be carried to *four significant digits.*

To Find the Logarithm of a Number in this Table.

315. Suppose it is required to find the logarithm of 65.7. In the column headed "N" look for the first two significant figures, and at the top of the table for the third significant figure. In the line with 65, and in the column headed 7, is seen 8176. To this number prefix the characteristic and insert the decimal point. Thus,

$$\log 65.7 = 1.8176.$$

Suppose it is required to find the logarithm of 20347. In the line with 20, and in the column headed 3, is seen 3075; also in the line with 20, and in the 4 column, is seen 3096, and the difference between these two is 21. The difference between 20300 and 20400 is 100, and the difference between 20300 and 20347 is 47. Hence, $\frac{47}{100}$ of $21 = 10$, nearly, must be added to 3075. That is,

$$\log 20347 = 4.3085.$$

Suppose it is required to find the logarithm of .0005076. In the line with 50, and in the 7 column, is seen 7050; in the 8 column, 7059: the difference is 9. The difference between 5070 and 5080 is 10, and the difference between 5070 and 5076 is 6. Hence, $\frac{6}{10}$ of $9 = 5$ must be added to 7050. That is,

$$\log .0005076 = 6.7055 - 10.$$

To Find a Number when its Logarithm is Given.

316. Suppose it is required to find the number of which the logarithm is 1.9736.

Look for 9736 in the table. In the column headed "N," and in the line with 9736, is seen 94, and at the head of

N	0	1	2	3	4	5	6	7	8	9
10	0000	0043	0086	0128	0170	0212	0253	0294	0334	0374
11	0414	0453	0492	0531	0569	0607	0645	0682	0719	0755
12	0792	0828	0864	0899	0934	0969	1004	1038	1072	1106
13	1139	1173	1206	1239	1271	1303	1335	1367	1399	1430
14	1461	1492	1523	1553	1584	1614	1644	1673	1703	1732
15	1761	1790	1818	1847	1875	1903	1931	1959	1987	2014
16	2041	2068	2095	2122	2148	2175	2201	2227	2253	2279
17	2304	2330	2355	2380	2405	2430	2455	2480	2504	2529
18	2553	2577	2601	2625	2648	2672	2695	2718	2742	2765
19	2788	2810	2833	2856	2878	2900	2923	2945	2967	2989
20	3010	3032	3054	3075	3096	3118	3139	3160	3181	3201
21	3222	3243	3263	3284	3304	3324	3345	3365	3385	3404
22	3424	3444	3464	3483	3502	3522	3541	3560	3579	3598
23	3617	3636	3655	3674	3692	3711	3729	3747	3766	3784
24	3802	3820	3838	3856	3874	3892	3909	3927	3945	3962
25	3979	3997	4014	4031	4048	4065	4082	4099	4116	4133
26	4150	4166	4183	4200	4216	4232	4249	4265	4281	4298
27	4314	4330	4346	4362	4378	4393	4409	4425	4440	4456
28	4472	4487	4502	4518	4533	4548	4564	4579	4594	4609
29	4624	4639	4654	4669	4683	4698	4713	4728	4742	4757
30	4771	4786	4800	4814	4829	4843	4857	4871	4886	4900
31	4914	4928	4942	4955	4969	4983	4997	5011	5024	5038
32	5051	5065	5079	5092	5105	5119	5132	5145	5159	5172
33	5185	5198	5211	5224	5237	5250	5263	5276	5289	5302
34	5315	5328	5340	5353	5366	5378	5391	5403	5416	5428
35	5441	5453	5465	5478	5490	5502	5514	5527	5539	5551
36	5563	5575	5587	5599	5611	5623	5635	5647	5658	5670
37	5682	5694	5705	5717	5729	5740	5752	5763	5775	5786
38	5798	5809	5821	5832	5843	5855	5866	5877	5888	5899
39	5911	5922	5933	5944	5955	5966	5977	5988	5999	6010
40	6021	6031	6042	6053	6064	6075	6085	6096	6107	6117
41	6128	6138	6149	6160	6170	6180	6191	6201	6212	6222
42	6232	6243	6253	6263	6274	6284	6294	6304	6314	6325
43	6335	6345	6355	6365	6375	6385	6395	6405	6415	6425
44	6435	6444	6454	6464	6474	6484	6493	6503	6513	6522
45	6532	6542	6551	6561	6571	6580	6590	6599	6609	6618
46	6628	6637	6646	6656	6665	6675	6684	6693	6702	6712
47	6721	6730	6739	6749	6758	6767	6776	6785	6794	6803
48	6812	6821	6830	6839	6848	6857	6866	6875	6884	6893
49	6902	6911	6920	6928	6937	6946	6955	6964	6972	6981
50	6990	6998	7007	7016	7024	7033	7042	7050	7059	7067
51	7076	7084	7093	7101	7110	7118	7126	7135	7143	7152
52	7160	7168	7177	7185	7193	7202	7210	7218	7226	7235
53	7243	7251	7259	7267	7275	7284	7292	7300	7308	7316
54	7324	7332	7340	7348	7356	7364	7372	7380	7388	7396

N	0	1	2	3	4	5	6	7	8	9
55	7404	7412	7419	7427	7435	7443	7451	7459	7466	7474
56	7482	7490	7497	7505	7513	7520	7528	7536	7543	7551
57	7559	7566	7574	7582	7589	7597	7604	7612	7619	7627
58	7634	7642	7649	7657	7664	7672	7679	7686	7694	7701
59	7709	7716	7723	7731	7738	7745	7752	7760	7767	7774
60	7782	7789	7796	7803	7810	7818	7825	7832	7839	7846
61	7853	7860	7868	7875	7882	7889	7896	7903	7910	7917
62	7924	7931	7938	7945	7952	7959	7966	7973	7980	7987
63	7993	8000	8007	8014	8021	8028	8035	8041	8048	8055
64	8062	8069	8075	8082	8089	8096	8102	8109	8116	8122
65	8129	8136	8142	8149	8156	8162	8169	8176	8182	8189
66	8195	8202	8209	8215	8222	8228	8235	8241	8248	8254
67	8261	8267	8274	8280	8287	8293	8299	8306	8312	8319
68	8325	8331	8338	8344	8351	8357	8363	8370	8376	8382
69	8388	8395	8401	8407	8414	8420	8426	8432	8439	8445
70	8451	8457	8463	8470	8476	8482	8488	8494	8500	8506
71	8513	8519	8525	8531	8537	8543	8549	8555	8561	8567
72	8573	8579	8585	8591	8597	8603	8609	8615	8621	8627
73	8633	8639	8645	8651	8657	8663	8669	8675	8681	8686
74	8692	8698	8704	8710	8716	8722	8727	8733	8739	8745
75	8751	8756	8762	8768	8774	8779	8785	8791	8797	8802
76	8808	8814	8820	8825	8831	8837	8842	8848	8854	8859
77	8865	8871	8876	8882	8887	8893	8899	8904	8910	8915
78	8921	8927	8932	8938	8943	8949	8954	8960	8965	8971
79	8976	8982	8987	8993	8998	9004	9009	9015	9020	9025
80	9031	9036	9042	9047	9053	9058	9063	9069	9074	9079
81	9085	9090	9096	9101	9106	9112	9117	9122	9128	9133
82	9138	9143	9149	9154	9159	9165	9170	9175	9180	9186
83	9191	9196	9201	9206	9212	9217	9222	9227	9232	9238
84	9243	9248	9253	9258	9263	9269	9274	9279	9284	9289
85	9294	9299	9304	9309	9315	9320	9325	9330	9335	9340
86	9345	9350	9355	9360	9365	9370	9375	9380	9385	9390
87	9395	9400	9405	9410	9415	9420	9425	9430	9435	9440
88	9445	9450	9455	9460	9465	9469	9474	9479	9484	9489
89	9494	9499	9504	9509	9513	9518	9523	9528	9533	9538
90	9542	9547	9552	9557	9562	9566	9571	9576	9581	9586
91	9590	9595	9600	9605	9609	9614	9619	9624	9628	9633
92	9638	9643	9647	9652	9657	9661	9666	9671	9675	9680
93	9685	9689	9694	9699	9703	9708	9713	9717	9722	9727
94	9731	9736	9741	9745	9750	9754	9759	9763	9768	9773
95	9777	9782	9786	9791	9795	9800	9805	9809	9814	9818
96	9823	9827	9832	9836	9841	9845	9850	9854	9859	9863
97	9868	9872	9877	9881	9886	9890	9894	9899	9903	9908
98	9912	9917	9921	9926	9930	9934	9939	9943	9948	9952
99	9956	9961	9965	9969	9974	9978	9983	9987	9991	9996

the column in which 9736 stands is seen 1. Therefore, write 941, and insert the decimal point as the characteristic directs. That is, the number required is 94.1.

Suppose it is required to find the number of which the logarithm is 3.7936.

Look for 7936 in the table. It cannot be found, but the two adjacent mantissas between which it lies are seen to be 7931 and 7938; their difference is 7, and the difference between 7931 and 7936 is 5. Therefore, $\frac{5}{7}$ of the difference between the numbers corresponding to the mantissas, 7931 and 7938, must be added to the number corresponding to the mantissa 7931.

The number corresponding to the mantissa 7938 is 6220.

The number corresponding to the mantissa 7931 is 6210.

The difference between these numbers is 10,

and $6210 + \frac{5}{7}$ of $10 = 6217$.

Therefore, the number required is 6217.

Suppose it is required to find the number of which the logarithm is $7.3882 - 10$.

Look for 3882 in the table. It cannot be found, but the two adjacent mantissas between which it lies are seen to be 3874 and 3892; their difference is 18, and the difference between 3874 and 3882 is 8. Therefore, $\frac{8}{18}$ of the difference between the numbers corresponding to the mantissas, 3874 and 3892, must be added to the number corresponding to the mantissa 3874.

The number corresponding to the mantissa 3892 is 2450.

The number corresponding to the mantissa 3874 is 2440.

The difference between these numbers is 10,

and $2440 + \frac{4}{9}$ of $10 = 2444$.

Therefore, the number required is .002444.

EXERCISE CXII.

Find logarithms of the following numbers:

1. 60.	6. 3780.	11. 70633.	16. 877.08.
2. 101.	7. 54327.	12. 12028.	17. 73.896.
3. 999.	8. 90801.	13. 0.00987.	18. 7.0699.
4. 9901.	9. 10001.	14. 0.87701.	19. 0.0897.
5. 5406.	10. 10010.	15. 1.0001.	20. 99.778.

Find antilogarithms to the following logarithms:

21. 4.2488.	25. 4.7317.	29. $9.0410 - 10$.
22. 3.6330.	26. 1.9730.	30. $9.8420 - 10$.
23. 2.5310.	27. $9.8800 - 10$.	31. $7.0216 - 10$.
24. 1.9484.	28. 0.2787.	32. $8.6580 - 10$.

Ex. Find the product of $908.4 \times .05392 \times 2.117$.

$$\begin{aligned} \log\ 908.4 &= 2.9583 \\ \log\ .05392 &= 8.7318 - 10 \\ \log\ 2.117 &= \underline{0.3257} \\ 2.0158 &= \log 103.7. \quad \textit{Ans.} \end{aligned}$$

Find by logarithms the following products:

33. 948.76×0.043875.	35. 830.75×0.0003769.
34. 3.4097×0.0087634.	36. 8.4395×0.98274.

317. When any of the factors are *negative*, find their logarithms without regard to the signs; write the letter n after the logarithm that corresponds to a negative number. If the number of logarithms so marked be *odd*, the product is *negative;* if *even*, the product is *positive.*

Find the products of:

37. $7564 \times (-0.003764)$.
38. $3.7648 \times (-0.083497)$.
39. $-5.840359 \times (-0.00178)$.
40. -8945.07×73.846.

Ex. Find the quotient of $\dfrac{8.3709 \times 834.637}{7308.946}$.

$$\begin{aligned} \log \quad & 8.3709 = 0.9227 \\ \log \quad & 834.637 = 2.9215 \\ \operatorname{colog} & 7308.946 = \underline{6.1362 - 10} \\ & 9.9804 - 10 = \log .9558. \quad \textit{Ans.} \end{aligned}$$

Find the quotients of:

41. $\dfrac{70654}{54013}$.
42. $\dfrac{58706}{93078}$.
43. $\dfrac{8.32165}{0.07891}$.
44. $\dfrac{65039}{90761}$.
45. $\dfrac{7.652}{-0.06875}$.
46. $\dfrac{0.07654}{83.947 \times 0.8395}$.
47. $\dfrac{7564 \times 0.07643}{8093 \times 0.09817}$.
48. $\dfrac{89 \times 753 \times 0.0097}{36709 \times 0.08497}$.
49. $\dfrac{413 \times 8.17 \times 3182}{915 \times 728 \times 2.315}$.
50. $\dfrac{212 \times (-6.12) \times (-2008)}{365 \times (-531) \times 2.576}$.

Ex. Find the cube of .0497.

$$\begin{aligned} & \log .0497 = 8.6964 - 10 \\ & \qquad\qquad \underline{\quad 3 \quad} \\ & 6.0892 - 10 = \log .0001228. \quad \textit{Ans.} \end{aligned}$$

Find by logarithms:

51. 6.05^{3}.
52. 1.051^{7}.
53. 1.1768^{5}.
54. 1.3178^{10}.
55. 0.78765^{6}.
56. 0.691^{9}.
57. $(\frac{7}{6}\frac{3}{1})^{11}$.
58. $(\frac{14}{51})^{7}$.
59. $(10\frac{2}{3})^{4}$.
60. $(1\frac{7}{9})^{8}$.
61. $(\frac{9}{8}\frac{5}{2}\frac{1}{8})^{6}$.
62. $(7\frac{6}{11})^{0.38}$.
63. $(3\frac{2}{8}\frac{7}{1})^{4.17}$.
64. $(1\frac{2}{11})^{3.2}$.
65. $(8\frac{3}{4})^{2.3}$.
66. $(5\frac{3}{5}\frac{1}{7})^{0.375}$.

Ex. Find the fourth root of 0.00862.

$$\log 0.00862 = 7.9355 - 10$$
$$30. \quad -30$$
$$4)\overline{37.9355 - 40}$$
$$9.4839 - 10 = \log .3047. \ \textit{Ans.}$$

Find by logarithms:

67. $7^{\frac{1}{3}}$.
68. $11^{\frac{1}{5}}$.
69. $783^{\frac{1}{2}}$.
70. $8379^{\frac{1}{10}}$.
71. $906.80^{\frac{1}{4}}$.
72. $8.1904^{\frac{1}{5}}$.
73. $0.17643^{\frac{5}{6}}$.
74. $2.5637^{\frac{3}{17}}$.
75. $(\frac{43}{788})^{\frac{1}{2}}$.
76. $(\frac{71}{48406})^{\frac{4}{7}}$.
77. $(9\frac{21}{43})^{\frac{1}{5}}$.
78. $(11\frac{21}{71})^{\frac{4}{5}}$.

Find by logarithms the values of:

79. $\sqrt[5]{\dfrac{0.0075433^2 \times 78.343 \times 8172.4^{\frac{1}{3}} \times 0.00052}{64285.^{\frac{1}{3}} \times 154.27^4 \times 0.001 \times 586.79^{\frac{1}{2}}}}$.

80. $\sqrt[5]{\dfrac{15.832^3 \times 5793.6^{\frac{1}{2}} \times 0.78426}{0.000327^{\frac{1}{3}} \times 768.94^2 \times 3015.3 \times 0.007^{\frac{1}{3}}}}$.

81. $\sqrt[5]{\dfrac{7.1895 \times 4764.2^2 \times 0.00326^5}{0.00048953 \times 457^3 \times 5764.4^2}}$.

82. $\sqrt[5]{\dfrac{3.1416 \times 4771.21 \times 2.7183^{\frac{1}{2}}}{30.103^4 \times 0.4343^{\frac{1}{2}} \times 69.897^4}}$.

83. $\sqrt[7]{\dfrac{0.03271^2 \times 53.429 \times 0.77542^3}{32.769 \times 0.000371^4}}$.

84. $\sqrt[5]{\dfrac{732.056^2 \times 0.0003572^4 \times 89793}{42.2798^3 \times 3.4574 \times 0.0026518^5}}$.

85. $\sqrt[3]{\dfrac{7932 \times 0.00657 \times 0.80464}{0.03274 \times 0.6428}}$.

86. $\sqrt[3]{\dfrac{7.1206 \times \sqrt{0.13274} \times 0.057389}{\sqrt{0.43468} \times 17.385 \times \sqrt{0.0096372}}}$.

87. $\left\{\dfrac{3.075526^3 \times 5771.2^{\frac{1}{2}} \times 0.0036984^{\frac{1}{3}} \times 7.74}{72258 \times 327.93^3 \times 86.97^5}\right\}^{\frac{1}{3}}$.

318. Since any positive number other than 1 may be taken as the base of a system of logarithms, the following general proofs to the base a should be noticed.

I. *The logarithm of the product of two or more numbers is equal to the sum of the logarithms of the numbers.*

For, let m and n be two numbers, and x and y their logarithms.

Then, by the definition of a logarithm, $m = a^x$, and $n = a^y$.

Hence, $$m \times n = a^x \times a^y = a^{x+y}.$$

$$\therefore \log (m \times n) = x + y,$$

$$= \log m + \log n.$$

In like manner, the proposition may be extended to any number of factors.

II. *The logarithm of a quotient is equal to the logarithm of the dividend minus the logarithm of the divisor.*

For, let m and n be two numbers, and x and y their logarithms.

Then $$m = a^x, \text{ and } n = a^y.$$

Hence, $$m \div n = a^x \div a^y = a^{x-y}.$$

$$\therefore \log (m \div n) = x - y,$$

$$= \log m - \log n.$$

From this it follows that $\log \frac{1}{m} = \log 1 - \log m$.

But, since $$\log 1 = 0, \log \frac{1}{m} = -\log m.$$

III. *The logarithm of a power of a number is equal to the logarithm of the number multiplied by the exponent of the power.*

For, let x be the logarithm of m.

Then $$m = a^x,$$

and $$m^p = (a^x)^p = a^{px}.$$

$$\therefore \log m^p = px,$$

$$= p \log m.$$

IV. *The logarithm of the root of a number is equal to the logarithm of the number divided by the index of the root.*

For, let x be the logarithm of m.

Then $$m = a^x,$$

and $$m^{\frac{1}{r}} = (a^x)^{\frac{1}{r}} = a^{\frac{x}{r}}.$$

$$\therefore \log m^{\frac{1}{r}} = \frac{x}{r} = \frac{\log m}{r}.$$

319. An **exponential equation,** that is, an equation in which the exponent is the unknown quantity, is easily solved by logarithms.

For, let $$a^x = m.$$

Then $$\log a^x = \log m,$$

$$\therefore x \log a = \log m,$$

$$\therefore x = \frac{\log m}{\log a}.$$

Ex. Find the value of x in $81^x = 10$.

$$81^x = 10,$$

$$x = \frac{\log 10}{\log 81},$$

$$\therefore \log x = \log \log 10 + \operatorname{colog} \log 81,$$

$$= 0 + 9.7193 - 10,$$

$$\therefore x = 0.52\dot{4}.$$

320. Logarithms of numbers to any base a may be converted into logarithms to any other base b by dividing the computed logarithms by the logarithm of b to the base a.

For, let $\log m = y$ to the base b,

and $\log b = x$ to the base a.

Then $m = b^y$, and $b = a^x$,

$$\therefore m = (a^x)^y = a^{xy}.$$

$\therefore \log m$ (to base a) $= xy = \log b$ (to base a) $\times \log m$ (to base b),

$$\therefore \log m \text{ (to base } b) = \frac{\log m \text{ (to base } a)}{\log b \text{ (to base } a)}.$$

This is usually written, $\log_b m = \frac{\log_a m}{\log_a b}$.

FIVE-PLACE

LOGARITHMIC AND TRIGONOMETRIC TABLES.

ARRANGED BY

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INTRODUCTION.

1. If the natural numbers are regarded as powers of ten, the exponents of the powers are the Common or Briggs Logarithms of the numbers. If A and B denote natural numbers, a and b their logarithms, then $10^a = A$, $10^b = B$; or, written in logarithmic form,

$$\log A = a, \qquad \log B = b.$$

2. The logarithm of a product is found by adding the logarithms of its factors.

For, $A \times B = 10^a \times 10^b = 10^{a+b}$.
Therefore, $\log (A \times B) = a + b = \log A + \log B$.

3. The logarithm of a quotient is found by subtracting the logarithm of the divisor from that of the dividend.

For, $\frac{A}{B} = \frac{10^a}{10^b} = 10^{a-b}$.

Therefore, $\log \frac{A}{B} = a - b = \log A - \log B$.

4. The logarithm of a power of a number is found by multiplying the logarithm of the number by the exponent of the power.

For, $A^n = (10^a)^n = 10^{an}$.
Therefore, $\log A^n = an = n \log A$.

5. The logarithm of the root of a number is found by dividing the logarithm of the number by the index of the root.

For, $\sqrt[n]{A} = \sqrt[n]{10^a} = 10^{\frac{a}{n}}$.

Therefore, $\log \sqrt[n]{A} = \frac{a}{n} = \frac{\log A}{n}$.

6. The logarithms of 1, 10, 100, etc., and of 0.1, 0.01, 0.001, etc., are integral numbers. The logarithms of all other numbers are fractions.

For, $10^0 = 1$, hence $\log 1 = 0$; $10^{-1} = 0.1$, hence $\log 0.1 = -1$;
$10^1 = 10$, hence $\log 10 = 1$; $10^{-2} = 0.01$, hence $\log 0.01 = -2$;
$10^2 = 100$, hence $\log 100 = 2$; $10^{-3} = 0.001$, hence $\log 0.001 = -3$;
$10^3 = 1000$, hence $\log 1000 = 3$; and so on.

If the number is between 1 and 10, the logarithm is between 0 and 1.
If the number is between 10 and 100, the logarithm is between 1 and 2.
If the number is between 100 and 1000, the logarithm is between 2 and 3.
If the number is between 1 and 0.1, the logarithm is between 0 and −1.
If the number is between 0.1 and 0.01, the logarithm is between −1 and −2.
If the number is between 0.01 and 0.001, the logarithm is between −2 and −3.
And so on.

7. If the number is less than 1, the logarithm is negative (§ 6), but is written in such a form that the *fractional part* is always *positive*.

For the number may be regarded as the product of two factors, one of which lies between 1 and 10, and the other is a negative power of 10; the logarithm will then take the form of a *difference* whose minuend is a positive proper fraction, and whose subtrahend is a positive integral number.

Thus, $0.48 = 4.8 \times 0.1$.
Therefore (§ 2), $\log 0.48 = \log 4.8 + \log 0.1 = 0.68124 - 1$. (Page 1.)
Again, $0.0007 = 7 \times 0.0001$.
Therefore, $\log 0.0007 = \log 7 + \log 0.0001 = 0.84510 - 4$.

8. Every logarithm, therefore, consists of two parts: a positive or negative integral number, which is called the **Characteristic**, and a *positive* proper fraction, which is called the **Mantissa.**

Thus, in the logarithm 3.52179, the integral number 3 is the characteristic, and the fraction .52179 the mantissa. In the logarithm $0.78254 - 2$, the integral number -2 is the characteristic, and the fraction .78254 is the mantissa.

9. If the logarithm is negative, it is customary to change the form of the difference so that the subtrahend shall be 10 or a multiple of 10. This is done by adding to both minuend and subtrahend a number which will increase the subtrahend to 10 or a multiple of 10.

Thus, the logarithm $0.78254 - 2$ is changed to $8.78254 - 10$ by adding 8 to both minuend and subtrahend. The logarithm $0.92737 - 13$ is changed to $7.92737 - 20$ by adding 7 to both minuend and subtrahend.

10. The following rules are derived from § 6: —

If the number is *greater than* 1, make the characteristic of the logarithm *one unit less* than the number of figures on the left of the decimal point.

If the number is *less than* 1, make the characteristic of the logarithm *negative*, and *one unit more* than the number of zeros between the decimal point and the first significant figure of the given number.

If the characteristic of a given logarithm is *positive*, make the number of figures in the integral part of the corresponding number *one more* than the number of units in the characteristic.

If the characteristic is *negative*, make the number of zeros between the decimal point and the first significant figure of the corresponding number *one less* than the number of units in the characteristic.

Thus, the characteristic of $\log 7849.27 = 3$;
the characteristic of $\log 0.037 = -2 = 8.00000 - 10$.

If the characteristic is 4, the corresponding number has five figures in its integral part. If the characteristic is -3, that is, $7.00000 - 10$, the corresponding fraction has two zeros between the decimal point and the first significant figure.

11. The logarithms of numbers that can be derived from one another by multiplication or division by an integral power of 10 have the same mantissa.

For, multiplying or dividing a number by an integral power of 10 will increase or diminish its logarithm by the exponent of that power of 10; and since this exponent is an integer, the mantissa of the logarithm will be unaffected.

Thus, $\log 4.6021 = 0.66296$. (Page 9.)

$\log 460.21 = \log (4.6021 \times 10^2) = \log 4.6021 + \log 10^2$
$= 0.66296 + 2 = 2.66296.$

$\log 460210 = \log (4.6021 \times 10^5) = \log 4.6021 + \log 10^5$
$= 0.66296 + 5 = 5.66296.$

$\log 0.046021 = \log (4.6021 \div 10^2) = \log 4.6021 - \log 10^2$
$= 0.66296 - 2 = 8.66296 - 10.$

TABLE I.

12. In this table (pp. 1–19) the vertical columns headed N contain the numbers, and the other columns the logarithms. On page 1 both the characteristic and the mantissa are printed. On pages 2–19 the mantissa only is printed.

The fractional part of a logarithm can be expressed only approximately, and in a five-place table all figures that follow the fifth are rejected. Whenever the sixth figure is 5, or more, the fifth figure is increased by 1. The figure $\underline{5}$ is written when the value of the figure in the place in which it stands, together with the succeeding figures, is more than $4\frac{1}{2}$, but less than 5.

Thus, if the mantissa of a logarithm written to seven places is 5328732, it is written in this table (a five-place table) 53287. If it is 5328751, it is written 53288. If it is 5328461 or 5328499, it is written in this table 5328$\underline{5}$.

Again, if the mantissa is 5324981, it is written 532$\underline{5}$0; and if it is 4999967, it is written $\underline{5}$0000.

This distinction between 5 and $\underline{5}$, in case it is desired to curtail still further the mantissas of logarithms, removes all doubt whether a 5 in the last given place, or in the last but one followed by a zero, should be simply rejected, or whether the rejection should lead us to increase the preceding figure by one unit.

Thus, the mantissa 13925 when reduced to four places should be 1392; but 13925 should be 1393.

To Find the Logarithm of a Given Number.

13. If the given number consists of one or two significant figures, the logarithm is given on page 1. If zeros follow the significant figures, or if the number is a proper decimal fraction, the characteristic must be determined by § 10.

14. If the given number has three significant figures, it will be found in the column headed N (pp. 2–19), and the mantissa of its logarithm in the next column to the right, and on the same line. Thus,

Page 2. $\log 145 = 2.16137$, $\log 14500 = 4.16137$.
Page 14. $\log 716 = 2.85491$, $\log 0.716 = 9.85491 - 10$.

15. If the given number has four significant figures, the first three will be found in the column headed N, and the fourth at the top of the page in the line containing the figures **1, 2, 3,** etc. The mantissa will be found in the column headed by the fourth figure, and on the same line with the first three figures. Thus,

Page 15. $\log 7682 = 3.88547$, $\log 76.85 = 1.88564$.
Page 18. $\log 93280 = 4.96979$, $\log 0.9468 = 9.97626 - 10$.

16. If the given number has five or more significant figures, a process called **interpolation** is required.

Interpolation is based on the *assumption* that between two consecutive mantissas of the table the change in the mantissa is directly proportional to the change in the number.

Required the logarithm of 34237.

The required mantissa is (§ 11) the same as the mantissa for 3423.7; therefore it will be found by adding to the mantissa of 3423 seven-tenths of the difference between the mantissas for 3423 and 3424.

The mantissa for 3423 is 53441.

The difference between the mantissas for 3423 and 3424 is 12.

Hence, the mantissa for 3423.7 is $53441 + (0.7 \times 12) = 53449$.

Therefore, the required logarithm of 34237 is 4.53449.

Required the logarithm of 0.0015764.

The required mantissa is the same as the mantissa for 1576.4; therefore it will be found by adding to the mantissa for 1576 four-tenths of the difference between the mantissas for 1576 and 1577.

The mantissa for 1576 is 19756.

The difference between the mantissas for 1576 and 1577 is 27.

Hence, the mantissa for 1576.4 is $19756 + (0.4 \times 27) = 19767$.

Therefore, the required logarithm of 0.0015764 is $7.19767 - 10$.

Required the logarithm of 32.6708.

The required mantissa is the same as the mantissa for 3267.08; therefore it will be found by adding to the mantissa for 3267 eight-hundredths of the difference between the mantissas for 3267 and 3268.

The mantissa for 3267 is 51415.

The difference between the mantissas for 3267 and 3268 is 13.

Hence, the mantissa for 3267.08 is $51415 + (0.08 \times 13) = 51416$.

Therefore, the required logarithm of 32.6708 is 1.51416.

17. When the fraction of a unit in the part to be added to the mantissa for four figures is less than 0.5 it is to be neglected; when it is 0.5 or more than 0.5 it is to be taken as one unit.

Thus, in the first example, the part to be added to the mantissa for 3423 is 8.4, and the .4 is rejected. In the second example, the part to be added to the mantissa for 1576 is 10.8, and 11 is added.

To Find the Number Corresponding to a Given Logarithm.

18. If the given mantissa can be found in the table, the first three figures of the required number will be found in the same line with the mantissa in the column headed N, and the fourth figure at the top of the column containing the mantissa.

The position of the decimal point is determined by the characteristic (§ 10).

Find the number corresponding to the logarithm 0.92002.

Page 16. The number for the mantissa 92002 is 8318.

Therefore, the required number is 8.318.

Find the number corresponding to the logarithm 6.09167.

Page 2. The number for the mantissa 09167 is 1235.

Therefore, the required number is 1235000.

Find the number corresponding to the logarithm $7.50325 - 10$.

Page 6. The number for the mantissa 50325 is 3186.

Therefore, the required number is 0.003186.

19. If the given mantissa cannot be found in the table, find in the table the two adjacent mantissas between which the given mantissa lies, and the four figures corresponding to the smaller of these two mantissas will be the first four significant figures of the required number. If more than four figures are desired, they may be found by interpolation, as in the following examples:

Find the number corresponding to the logarithm 1.48762.

Here the two adjacent mantissas of the table, between which the given mantissa 48762 lies, are found to be (page 6) 48756 and 48770. The corresponding numbers are 3073 and 3074. The smaller of these, 3073, contains the first four significant figures of the required number.

The difference between the two adjacent mantissas is 14, and the difference between the corresponding numbers is 1.

The difference between the smaller of the two adjacent mantissas, 48756, and the given mantissa, 48762, is 6. Therefore, the number to be annexed to 3073 is $\frac{6}{14}$ of $1 = 0.428$, and the fifth significant figure of the required number is 4.

Hence, the required number is 30.734.

Find the number corresponding to the logarithm $7.82326 - 10$.

The two adjacent mantissas between which 82326 lies are (page 13) 82321 and 82328. The number corresponding to the mantissa 82321 is 6656.

The difference between the two adjacent mantissas is 7, and the difference between the corresponding numbers is 1.

The difference between the smaller mantissa, 82321, and the given mantissa, 82326, is 5. Therefore, the number to be annexed to 6656 is $\frac{5}{7}$ of $1 = 0.7$, and the fifth significant figure of the required number is 7.

Hence, the required number is 0.0066567.

In using a five-place table the numbers corresponding to mantissas may be carried to five significant figures, and in the first part of the table to six figures.*

20. The logarithm of the reciprocal of a number is called the **Cologarithm** of the number.

If A denote any number, then

$$\operatorname{colog} A = \log \frac{1}{A} = \log 1 - \log A \ (\S\ 3) = -\log A.$$

Hence, the cologarithm of a number is equal to the logarithm of the number with the minus sign prefixed, which sign affects the entire logarithm, both characteristic and mantissa.

* In most tables of logarithms proportional parts are given as an aid to interpolation; but, after a little practice, the operation can be performed nearly as rapidly without them. Their omission allows a page with larger-faced type and more open spacing, and consequently less trying to the eyes.

In order to avoid a negative mantissa in the cologarithm, it is customary to substitute for $-\log A$ its equivalent

$$(10 - \log A) - 10.$$

Hence, the cologarithm of a number is found by subtracting the logarithm of the number from 10, and then annexing -10 to the remainder.

The best way to perform the subtraction is to begin on the left and subtract each figure of $\log A$ from 9 until we reach the last significant figure, which must be subtracted from 10.

If $\log A$ is greater in absolute value than 10 and less than 20, then in order to avoid a negative mantissa, it is necessary to write $-\log A$ in the form

$$(20 - \log A) - 20.$$

So that, in this case, $\operatorname{colog} A$ is found by subtracting $\log A$ from 20, and then annexing -20 to the remainder.

Find the cologarithm of 4007.

Page 8.

$$\begin{aligned} &\qquad\qquad 10 \qquad -10 \\ \log 4007 &= 3.60282 \\ \operatorname{colog} 4007 &= 6.39718 - 10 \end{aligned}$$

Find the cologarithm of 103992000000.

Page 2.

$$\begin{aligned} &\qquad\qquad 20 \qquad -20 \\ \log 103992000000 &= 11.01700 \\ \operatorname{colog} 103992000000 &= 8.98300 - 20 \end{aligned}$$

If the characteristic of $\log A$ is negative, then the subtrahend, -10 or -20, will vanish in finding the value of $\operatorname{colog} A$.

Find the cologarithm of 0.004007.

$$\begin{aligned} &\qquad\qquad 10 \qquad -10 \\ \log 0.004007 &= 7.60282 - 10 \\ \operatorname{colog} 0.004007 &= 2.39718 \end{aligned}$$

With practice, the cologarithm of a number can be taken from the table as rapidly as the logarithm itself.

By using cologarithms the inconvenience of subtracting the logarithm of a divisor is avoided. For dividing by a number is equivalent to multiplying by its reciprocal. Hence, instead of subtracting the logarithm of a divisor its cologarithm may be added.

Computation by Logarithms.

21. (1) Find the value of x, if $x = 72214 \times 0.08203$.

Page 14.	$\log 72214$	$= 4.85862$
Page 16.	$\log 0.08203$	$= 8.91397 - 10$
By § 2.	$\log x$	$= 3.77259$
Page 11.	x	$= 5923.63$

(2) Find the value of x, if $x = 5250 \div 23487$.

Page 10.	$\log 5250$	$= 3.72016$
Page 4.	$\operatorname{colog} 23487$	$= 5.62917 - 10$
Page 4.	$\log x$	$= 9.34933 - 10 = \log 0.22353$
	$\therefore x$	$= 0.22353$

(3) Find the value of x, if $x = \dfrac{7.56 \times 4667 \times 567}{899.1 \times 0.00337 \times 23435}$

Page 15.	$\log 7.56$	$= 0.87852$
Page 9.	$\log 4667$	$= 3.66904$
Page 11.	$\log 567$	$= 2.75358$
Page 17.	$\operatorname{colog} 899.1$	$= 7.04619 - 10$
Page 6.	$\operatorname{colog} 0.00337$	$= 2.47237$
Page 4.	$\operatorname{colog} 23435$	$= 5.63013 - 10$
Page 5.	$\log x$	$= 2.44983 = \log 281.73$
	$\therefore x$	$= 281.73$

(4) Find the cube of 376.

Page 7.	$\log 376$	$= 2.57519$
Multiply by 3 (§ 4),		$\times 3$
Page 10.	$\log 376^3$	$= 7.72557 = \log 53158600$
	$\therefore 376^3$	$= 53158600$

(5) Find the square of 0.003278.

Page 6.	$\log 0.003278 =$	$7.51561 - 10$
		$\times 2$
Page 2.	$\log 0.003278^2 =$	$15.03122 - 20 = \log 0.000010745$
	$\therefore 0.003278^2 =$	0.000010745

(6) Find the square root of 8322.

Page 16.	$\log 8322$	$= 3.92023$
Divide by 2 (§ 5),		$2) 3.92023$
	$\log \sqrt{8322}$	$= 1.96012 = \log 91.226$
	$\therefore \sqrt{8322}$	$= 91.226$

If the given number is a proper fraction, its logarithm will have as a subtrahend 10 or a multiple of 10. In this case, before dividing the logarithm by the index of the root, both the subtrahend and the num-

ber preceding the mantissa should be increased by such a number as will make the subtrahend, when divided by the index of the root, 10 or a multiple of 10.

(7) Find the square root of 0.000043641.

Page 8. $\log 0.000043641 = 5.63989 - 10$

$10 \quad -10$

Divide by 2 (§ 5), $2\overline{)15.63989 - 20}$

Page 13. $\log \sqrt{0.000043641} = 7.81995 - 10 = \log 0.0066062$

$\therefore \sqrt{0.000043641} = 0.0066062$

(8) Find the sixth root of 0.076553.

Page 15. $\log 0.076553 = 8.88397 - 10$

$50 \quad -50$

Divide by 6 (§ 5), $6\overline{)58.88397 - 60}$

Page 13 $\log \sqrt[6]{0.076553} = 9.81400 - 10 = \log 0.65163$

$\therefore \sqrt[6]{0.076553} = 0.65163$

TABLE II.

22. This table (page 20) contains the value of the number π, its most useful combinations, and their logarithms.

Find the length of an arc of 47° 32′ 57″ in a unit circle.

$47° 32' 57'' = 171177''$

$\log 171177 = 5.23344$

$\log \frac{1}{a''} = 4.68557 - 10$

$\log \text{arc } 47° 32' 57'' = 9.91901 - 10 = \log 0.82994$

$\therefore \text{length of arc} = 0.82994$

Find the angle if the length of its arc in a unit circle = 0.54936.

$\log 0.54936 = 9.73986 - 10$

$\operatorname{colog} \frac{1}{a''} = \log a'' = 5.31443$

$\log \text{angle} = 5.05429 = \log 113316$

$\therefore \text{angle} = 113316'' = 31° 28' 36''$

23. The relations between arcs and angles given in Table II. are readily deduced from the circular measure of an angle.

In **Circular Measure** an angle is defined by the equation

$$\text{angle} = \frac{\text{arc}}{\text{radius}},$$

in which the word arc denotes the length of the arc corresponding to the angle, when both arc and radius are expressed in terms of the *same linear unit.*

Since the arc and radius for a given angle in different circles vary in the same ratio, the value of the angle given by this equation is independent of the value of the radius. If the radius is unity, the equation defining the angle becomes

$$\text{angle} = \text{arc}.$$

That is, in circular measure an angle is measured by the length of its arc in a unit circle. Therefore,

If the arc = circumference, the angle $= 2\pi$.
If the arc = semicircumference, the angle $= \pi$.
If the arc = quadrant, the angle $= \frac{1}{2}\pi$.
If the arc = radius $(= 1)$, the angle $= 1$;

that is, in circular measure the angular unit is the angle whose arc is equal in length to the radius of the circle.

Since 180° in common measure equals π units in circular measure, therefore

$$1° \text{ in common measure} = \frac{\pi}{180} \text{ units in circular measure};$$

$$1 \text{ unit in circular measure} = \frac{180°}{\pi} \text{ in common measure}.$$

By means of these two equations, the value of an angle expressed in one measure may be changed to its value in the other measure.

Thus, the angle whose arc is equal to the radius is an angle of 1 unit in circular measure, and is equal to $\frac{180°}{\pi}$, or 57° 17′ 45″, very nearly.

TABLE III.

24. This table (pp. 21–49) contains the logarithms of the trigonometric functions of angles. In order to avoid negative characteristics, the characteristic of every logarithm is printed 10 too large. Therefore, − 10 is to be annexed to each logarithm.

On pages 28–49 the characteristic remains the same throughout each column, and is printed at the top and the bottom of the column. But on page 30 the characteristic changes one unit in value at the places marked with bars. Above these bars the proper characteristic is printed at the top, and below them at the bottom, of the column.

25. On pages 28–49 the log sin, log tan, log cot, and log cos, of 1° to 89°, are given to every minute. Conversely, this part of the table gives the value of the angle to the nearest minute when log sin, log tan, log cot, or log cos is known, provided log sin or log cos lies between 8.23822 and 9.99992, and log tan or log cot lies between 8.23829 and 11.76171.

If the exact value of the given logarithm of a function is not found in the table, the value nearest to it is to be taken, unless interpolation is employed as explained in § 26.

If the angle is less than 45°, the number of degrees is printed at the top of the page, and the number of minutes in the column to the left of the columns containing the logarithm. If the angle is greater than 45°, the number of degrees is printed at the bottom of the page, and the number of minutes in the column to the right of the columns containing the logarithms.

If the angle is less than 45°, the names of its functions are printed at the top of the page; if greater than 45°, at the bottom of the page. Thus,

Page 38. $\log \sin 21° 37' = 9.56631 - 10.$
Page 45. $\log \cot 36° 53' = 10.12473 - 10 = 0.12473.$
Page 37. $\log \cos 69° 14' = 9.54969 - 10.$
Page 49. $\log \tan 45° 59' = 10.01491 - 10 = 0.01491.$
Page 48. If $\log \cos = 9.87468 - 10$, angle $= 41° 28'$.
Page 34. If $\log \cot = 9.39353 - 10$, angle $= 76° 6'$.

If $\log \sin = 9.47760 - 10$, the nearest log sin in the table is $9.47774 - 10$ (page 36), and the angle corresponding to this value is $17° 29'$.

If $\log \tan = 0.76520 = 10.76520 - 10$, the nearest log tan in the table is $10.76490 - 10$ (page 32), and the angle corresponding to this value is $80° 15'$.

26. If it is desired to obtain the logarithms of the functions of angles that contain seconds, or to obtain the value of the angle in degrees, minutes, and seconds, from the logarithms of its functions, interpolation must be employed. Here it must be remembered that,

The difference between two consecutive angles in the table is $60''$.

Log sin and log tan increase as the angle increases; log cos and log cot diminish as the angle increases.

Find $\log \tan 70° 46' 8''$.

Page 37. $\log \tan 70° 46' = 0.45731.$

The difference between the mantissas of $\log \tan 70° 46'$ and $\log \tan 70° 47'$ is 41, and $\frac{8}{60}$ of $41 = 5$.

As the function is increasing, the 5 must be added to the figure in the fifth place of the mantissa 45731; and

Therefore $\log \tan 70° 46' 8'' = 0.45736.$

Find $\log \cos 47° 35' 4''$.

Page 48. $\log \cos 47° 35' = 9.82899 - 10.$

The difference between this mantissa and the mantissas of the next log cos is 14, and $\frac{4}{60}$ of $14 = 1$.

As the function is decreasing, the 1 must be subtracted from the figure in the fifth place of the mantissa 82899; and

Therefore $\log \cos 47° 35' 4'' = 9.82898 - 10.$

Find the angle for which log sin = 9.45359 − 10.

Page 35. The mantissa of the nearest smaller log sin in the table is 45334.
The angle corresponding to this value is 16° 30′.
The difference between 45334 and the given mantissa, 45359, is 25.
The difference between 45334 and the next following mantissa, 45377, is 43, and $\frac{25}{43}$ of 60″ = 35″.
As the function is increasing, the 35″ must be added to 16° 30′; and the required angle is 16° 30′ 35″.

Find the angle for which log cot = 0.73478.

Page 32. The mantissa of the nearest smaller log cot in the table is 73415.
The angle corresponding to this value is 10° 27′.
The difference between 73415 and the given mantissa is 63.
The difference between 73415 and next following mantissa is 71, and $\frac{63}{71}$ of 60″ = 53″.
As the function is decreasing, the 53″ must be subtracted from 10° 27′; and the required angle is 10° 26′ 7″.

27. If log sec or log csc of an angle is desired, it may be found from the table by the formulas,

$$\sec A = \frac{1}{\cos A}; \quad \text{hence, } \log\sec A = \operatorname{colog}\cos A.$$

$$\csc A = \frac{1}{\sin A}; \quad \text{hence, } \log\csc A = \operatorname{colog}\sin A.$$

Page 31. log sec 8° 28′ = colog cos 8° 28′ = 0.00476.
Page 42. log csc 59° 36′ 44″ = colog sin 59° 36′ 44″ = 0.06418.

28. If a given angle is between 0° and 1°, or between 89° and 90°; or, conversely, if a given log sin or log cos does *not* lie between the limits 8.23822 and 9.99992 in the table; or, if a given log tan or log cot does *not* lie between the limits 8.23829 and 11.76171 in the table; then pages 21–24 of Table III. must be used.

On page 21, log sin of angles between 0° and 0° 3′, or log cos of the complementary angles between 89° 57′ and 90°, are given to every second; for the angles between 0° and 0° 3′, log tan = log sin, and log cos = 0.00000; for the angles between 89° 57′ and 90°, log cot = log cos, and log sin = 0.00000.

On pages 22–24, log sin, log tan, and log cos of angles between 0° and 1°, or log cos, log cot, and log sin of the complementary angles between 89° and 90°, are given to every 10″.

Whenever log tan or log cot is not given, they may be found by the formulas,

log tan = colog cot. log cot = colog tan.

Conversely, if a given log tan or log cot is not contained in the table, then the colog must be found; this will be the log cot or log tan, as the case may be, and will be contained in the table.

On pages 25–27 the logarithms of the functions of angles between 1° and 2°, or between 88° and 90°, are given in the manner employed on pages 22–24. These pages should be used if the angle lies between these limits, and if not only degrees and minutes, but degrees, minutes, and multiples of 10″ are given or required.

When the angle is between 0° and 2°, or 88° and 90°, and a greater degree of accuracy is desired than that given by the table, interpolation may be employed; but for these angles interpolation does not always give true results, and it is better to use Table IV.

Find log tan 0° 2′ 47″, and log cos 89° 37′ 20″.

Page 21. $\log \tan 0° 2' 47'' = \log \sin 0° 2' 47'' = 6.90829 - 10.$
Page 23. $\log \cos 89° 37' 20'' = 7.81911 - 10.$

Find log cot 0° 2′ 15″.

$$\begin{array}{lll} & & 10 \quad -10 \\ \text{Page 21.} & \log \tan 0° 2' 15'' & = 6.81591 - 10 \\ \text{Therefore,} & \log \cot 0° 2' 15'' & = 3.18409 \end{array}$$

Find log tan 89° 38′ 30″.

$$\begin{array}{lll} & & 10 \quad -10 \\ \text{Page 23.} & \log \cot 89° 38' 30'' & = 7.79617 - 10 \\ \text{Therefore,} & \log \tan 89° 38' 30'' & = 2.20383 \end{array}$$

Find the angle for which log tan = 6.92090 − 10.

Page 21. The nearest log tan is 6.92110 − 10.
The corresponding angle for which is 0° 2′ 52″.

Find the angle for which log cos = 7.70240 − 10.

Page 22. The nearest log cos is 7.70261 − 10.
The corresponding angle for which is 89° 42′ 40″.

Find the angle for which log cot = 2.37368.

This log cot is not contained in the table.
The colog cot = 7.62632 − 10 = log tan.
The log tan in the table nearest to this is (page 22) 7.62510 − 10, and the angle corresponding to this value of log tan is 0° 14′ 30″.

29. If an angle x is between 90° and 360°, it follows, from formulas established in Trigonometry, that,

between 90° and 180°,	between 180° and 270°,
$\log \sin x = \log \sin (180° - x)$,	$\log \sin x = \log \sin (x - 180°)_n$,
$\log \cos x = \log \cos (180° - x)_n$,	$\log \cos x = \log \cos (x - 180°)_n$,
$\log \tan x = \log \tan (180° - x)_n$,	$\log \tan x = \log \tan (x - 180°)$,
$\log \cot x = \log \cot (180° - x)_n$;	$\log \cot x = \log \cot (x - 180°)$;

between 270° and 360°,

$$\log \sin x = \log \sin (360° - x)_n,$$
$$\log \cos x = \log \cos (360° - x),$$
$$\log \tan x = \log \tan (360° - x)_n,$$
$$\log \cot x = \log \cot (360° - x)_n.$$

The letter n is placed (according to custom) after the logarithms of those functions which are negative in value.

The above formulas show, without further explanation, how to find by means of Table III. the logarithms of the functions of any angle between 90° and 360°.

Thus, $\log \sin 137° 46' 22'' = \log \sin 42° 14' 38'' = 9.82756 - 10.$
$\log \cos 137° 46' 22'' = \log_n \cos 42° 14' 38'' = 9.86940_n - 10.$
$\log \tan 137° 46' 22'' = \log_n \tan 42° 14' 38'' = 9.95815_n - 10.$
$\log \cot 137° 46' 22'' = \log_n \cot 42° 14' 38'' = 0.04185_n.$
$\log \sin 209° 32' 50'' = \log_n \sin 29° 32' 50'' = 9.69297_n - 10.$
$\log \cos 330° 27' 10'' = \log \cos 29° 32' 50'' = 9.93949 - 10.$

Conversely, to a given logarithm of a trigonometric function there correspond between 0° and 360° four angles, one angle in each quadrant, and so related that if x denote the acute angle, the other three angles are $180° - x$, $180° + x$, and $360° - x$.

If besides the given logarithm it is known whether the function is positive or negative, the ambiguity is confined to *two* quadrants, therefore to *two* angles.

Thus, if the $\log \tan = 9.47451 - 10$, the angles are 16° 36′ 17″ in Quadrant I. and 196° 36′ 17″ in Quadrant III.; but if the $\log \tan = 9.47451_n - 10$, the angles are 163° 23′ 43″ in Quadrant II. and 343° 23′ 43″ in Quadrant IV.

To remove all ambiguity, further conditions are required, or a knowledge of the special circumstances connected with the problem in question.

TABLE IV.

30. This table (page 50) must be used when great accuracy is desired in working with angles between 0° and 2°, or between 88° and 90°.

The values of S and T are such that when the angle a is expressed in seconds,

$$S = \log \sin a - \log a'',$$
$$T = \log \tan a - \log a''.$$

Hence follow the formulas given on page 50.

The values of S and T are printed with the characteristic 10 too large, and in using them -10 must always be annexed.

Find $\log \sin 0° 58' 17''$.

$0° 58' 17'' = 3497''$
$\log 3497 = 3.54370$
$S = 4.68555 - 10$
$\log \sin 0° 58' 17'' = 8.22925 - 10$

Find $\log \cos 88° 26' 41.2''$.

$90° - 88° 26' 41.2'' = 1° 33' 18.8''$
$= 5598.8''$
$\log 5598.8 = 3.74809$
$S = 4.68552 - 10$
$\log \cos 88° 26' 41.2'' = 8.43361 - 10$

Find $\log \tan 0° 52' 47.5''$.

$0° 52' 47.5'' = 3167.5''$
$\log 3167.5 = 3.50072$
$T = 4.68561 - 10$
$\log \tan 0° 52' 47.5'' = 8.18633 - 10$

Find $\log \tan 89° 54' 37.362''$.

$90° - 89° 54' 37.362'' = 0° 5' 22.638'$
$= 322.638''$
$\log 322.638 = 2.50871$
$T = 4.68558 - 10$
$\log \cot 89° 54' 37.362'' = 7.19429 - 10$
$\log \tan 89° 54' 37.362'' = 2.80571$

Find the angle, if $\log \sin = 6.72306 - 10$.

$6.72306 - 10$
$S = 4.68557 - 10$

Subtract, $2.03749 = \log 109.015$
$109.015'' = 0° 1' 49.015''$

Find the angle for which $\log \cot = 1.67604$.

$\operatorname{colog} \cot = 8.32396 - 10$
$T = 4.68564 - 10$

Subtract, $3.63832 = \log 4348.3$
$4348.3'' = 1° 12' 28.3''$

Find the angle for which $\log \tan = 1.55407$.

$\operatorname{colog} \tan = 8.44593 - 10$
$T = 4.68569 - 10$

Subtract, $3.76024 = \log 5757.6$
$5757.6'' = 1° 35' 57.6''$,
and $90° - 1° 35' 57.6'' = 88° 24' 2.4''$.
Therefore, the angle required is $88° 24' 2.4''$.

TABLE V.

31. Table V. (pp. 51–53), contains the natural sines, cosines, tangents, and cotangents of angles from 0° to 90°, at intervals of 10′. If greater accuracy is desired it may be obtained by interpolation.

TABLE VI.

32. This table (p. 54), containing the circumferences and areas of circles, does not require explanation.

NOTE. In preparing the preceding explanations, free use has been made of the Logarithmic Tables by F. G. Gauss, from which, also, Tables II. and VI. have been taken.

TABLE VII.

33. This table (pp. 55–60) gives the latitude and departure to three places of decimals for distances from 1 to 10, corresponding to bearings from 0° to 90° at intervals of 15′.

If the bearing does not exceed 45° it is found in the *left*-hand column, and the designations of the columns under "Distance" are taken from the *top* of the page; but if the bearing exceeds 45°, it is found in the *right*-hand column, and the designations of the columns under "Distance" are taken from the *bottom* of the page.

The method of using the table will be made plain by the following examples: —

(1) Let it be required to find the latitude and departure of the course N. 35° 15′ E. 6 chains.

On p. 60, left-hand column, look for 35° 15′; opposite this bearing, in the vertical column headed "Distance 6," are found 4.900 and 3.463 under the headings "Latitude" and "Departure" respectively. Hence, latitude or northing = 4.900 chains, and departure or easting = 3.463 chains.

(2) Let it be required to find the latitude and departure of the course S. 87° W. 2 chains.

As the bearing exceeds 45°, we look in the right-hand column of p. 55, and opposite 87° in the column marked "Distance 2" we find (taking the designations of the columns from the bottom of the page) latitude = .105 chains, and departure = 1.997 chains. Hence, latitude or southing = .105 chains, and departure or westing = 1.997 chains.

(3) Let it be required to find the latitude and departure of the course N. 15° 45′ W. 27.36 chains.

In this case we find the required numbers for each figure of the distance separately, arranging the work as in the following table. In practice, only the last columns under "Latitude" and "Departure" are written.

Distance.	Latitude.	Departure.
20 = 2 × 10	1.925 × 10 = 19.25	0.543 × 10 = 5.43
7	6.737	1.90
0.3 = 3 ÷ 10	2.887 ÷ 10 = 0.289	0.814 ÷ 10 = 0.081
0.06 = 6 ÷ 100	5.775 ÷ 100 = 0.058	1.628 ÷ 100 = 0.016
27.36	26.334	7.427

Hence, latitude = 26.334 chains, and departure = 7.427 chains.

TABLE I.

THE

COMMON OR BRIGGS LOGARITHMS

OF THE

NATURAL NUMBERS

From 1 to 10000.

1—100

N	log	N	log	N	log	N	log	N	log
1	0.00 000	21	1.32 222	41	1.61 278	61	1.78 533	81	1.90 849
2	0.30 103	22	1.34 242	42	1.62 325	62	1.79 239	82	1.91 381
3	0.47 712	23	1.36 173	43	1.63 347	63	1.79 934	83	1.91 908
4	0.60 206	24	1.38 021	44	1.64 345	64	1.80 618	84	1.92 428
5	0.69 897	25	1.39 794	45	1.65 321	65	1.81 291	85	1.92 942
6	0.77 815	26	1.41 497	46	1.66 276	66	1.81 954	86	1.93 450
7	0.84 510	27	1.43 136	47	1.67 210	67	1.82 607	87	1.93 952
8	0.90 309	28	1.44 716	48	1.68 124	68	1.83 251	88	1.94 448
9	0.95 424	29	1.46 240	49	1.69 020	69	1.83 885	89	1.94 939
10	1.00 000	30	1.47 712	50	1.69 897	70	1.84 510	90	1.95 424
11	1.04 139	31	1.49 136	51	1.70 757	71	1.85 126	91	1.95 904
12	1.07 918	32	1.50 515	52	1.71 600	72	1.85 733	92	1.96 379
13	1.11 394	33	1.51 851	53	1.72 428	73	1.86 332	93	1.96 848
14	1.14 613	34	1.53 148	54	1.73 239	74	1.86 923	94	1.97 313
15	1.17 609	35	1.54 407	55	1.74 036	75	1.87 506	95	1.97 772
16	1.20 412	36	1.55 630	56	1.74 819	76	1.88 081	96	1.98 227
17	1.23 045	37	1.56 820	57	1.75 587	77	1.88 649	97	1.98 677
18	1.25 527	38	1.57 978	58	1.76 343	78	1.89 209	98	1.99 123
19	1.27 875	39	1.59 106	59	1.77 085	79	1.89 763	99	1.99 564
20	1.30 103	40	1.60 206	60	1.77 815	80	1.90 309	100	2.00 000
N	log	N	log	N	log	N	log	N	log

100—150

N	0	1	2	3	4	5	6	7	8	9
100	00 000	00 043	00 087	00 130	00 173	00 217	00 260	00 303	00 346	00 389
101	00 432	00 475	00 518	00 561	00 604	00 647	00 689	00 732	00 775	00 817
102	00 860	00 903	00 945	00 988	01 030	01 072	01 115	01 157	01 199	01 242
103	01 284	01 326	01 368	01 410	01 452	01 494	01 536	01 578	01 620	01 662
104	01 703	01 745	01 787	01 828	01 870	01 912	01 953	01 995	02 036	02 078
105	02 119	02 160	02 202	02 243	02 284	02 325	02 366	02 407	02 449	02 490
106	02 531	02 572	02 612	02 653	02 694	02 735	02 776	02 816	02 857	02 898
107	02 938	02 979	03 019	03 060	03 100	03 141	03 181	03 222	03 262	03 302
108	03 342	03 383	03 423	03 463	03 503	03 543	03 583	03 623	03 663	03 703
109	03 743	03 782	03 822	03 862	03 902	03 941	03 981	04 021	04 060	04 100
110	04 139	04 179	04 218	04 258	04 297	04 336	04 376	04 415	04 454	04 493
111	04 532	04 571	04 610	04 650	04 689	04 727	04 766	04 805	04 844	04 883
112	04 922	04 961	04 999	05 038	05 077	05 115	05 154	05 192	05 231	05 269
113	05 308	05 346	05 385	05 423	05 461	05 500	05 538	05 576	05 614	05 652
114	05 690	05 729	05 767	05 805	05 843	05 881	05 918	05 956	05 994	06 032
115	06 070	06 108	06 145	06 183	06 221	06 258	06 296	06 333	06 371	06 408
116	06 446	06 483	06 521	06 558	06 595	06 633	06 670	06 707	06 744	06 781
117	06 819	06 856	06 893	06 930	06 967	07 004	07 041	07 078	07 115	07 151
118	07 188	07 225	07 262	07 298	07 335	07 372	07 408	07 445	07 482	07 518
119	07 555	07 591	07 628	07 664	07 700	07 737	07 773	07 809	07 846	07 882
120	07 918	07 954	07 990	08 027	08 063	08 099	08 135	08 171	08 207	08 243
121	08 279	08 314	08 350	08 386	08 422	08 458	08 493	08 529	08 565	08 600
122	08 636	08 672	08 707	08 743	08 778	08 814	08 849	08 884	08 920	08 955
123	08 991	09 026	09 061	09 096	09 132	09 167	09 202	09 237	09 272	09 307
124	09 342	09 377	09 412	09 447	09 482	09 517	09 552	09 587	09 621	09 656
125	09 691	09 726	09 760	09 795	09 830	09 864	09 899	09 934	09 968	10 003
126	10 037	10 072	10 106	10 140	10 175	10 209	10 243	10 278	10 312	10 346
127	10 380	10 415	10 449	10 483	10 517	10 551	10 585	10 619	10 653	10 687
128	10 721	10 755	10 789	10 823	10 857	10 890	10 924	10 958	10 992	11 025
129	11 059	11 093	11 126	11 160	11 193	11 227	11 261	11 294	11 327	11 361
130	11 394	11 428	11 461	11 494	11 528	11 561	11 594	11 628	11 661	11 694
131	11 727	11 760	11 793	11 826	11 860	11 893	11 926	11 959	11 992	12 024
132	12 057	12 090	12 123	12 156	12 189	12 222	12 254	12 287	12 320	12 352
133	12 385	12 418	12 450	12 483	12 516	12 548	12 581	12 613	12 646	12 678
134	12 710	12 743	12 775	12 808	12 840	12 872	12 905	12 937	12 969	13 001
135	13 033	13 066	13 098	13 130	13 162	13 194	13 226	13 258	13 290	13 322
136	13 354	13 386	13 418	13 450	13 481	13 513	13 545	13 577	13 609	13 640
137	13 672	13 704	13 735	13 767	13 799	13 830	13 862	13 893	13 925	13 956
138	13 988	14 019	14 051	14 082	14 114	14 145	14 176	14 208	14 239	14 270
139	14 301	14 333	14 364	14 395	14 426	14 457	14 489	14 520	14 551	14 582
140	14 613	14 644	14 675	14 706	14 737	14 768	14 799	14 829	14 860	14 891
141	14 922	14 953	14 983	15 014	15 045	15 076	15 106	15 137	15 168	15 198
142	15 229	15 259	15 290	15 320	15 351	15 381	15 412	15 442	15 473	15 503
143	15 534	15 564	15 594	15 625	15 655	15 685	15 715	15 746	15 776	15 806
144	15 836	15 866	15 897	15 927	15 957	15 987	16 017	16 047	16 077	16 107
145	16 137	16 167	16 197	16 227	16 256	16 286	16 316	16 346	16 376	16 406
146	16 435	16 465	16 495	16 524	16 554	16 584	16 613	16 643	16 673	16 702
147	16 732	16 761	16 791	16 820	16 850	16 879	16 909	16 938	16 967	16 997
148	17 026	17 056	17 085	17 114	17 143	17 173	17 202	17 231	17 260	17 289
149	17 319	17 348	17 377	17 406	17 435	17 464	17 493	17 522	17 551	17 580
150	17 609	17 638	17 667	17 696	17 725	17 754	17 782	17 811	17 840	17 869

N 0 1 2 3 4 5 6 7 8 9

100—150

150 — 200

N	0	1	2	3	4	5	6	7	8	9
150	17 609	17 638	17 667	17 696	17 725	17 754	17 782	17 811	17 840	17 869
151	17 898	17 926	17 955	17 984	18 013	18 041	18 070	18 099	18 127	18 156
152	18 184	18 213	18 241	18 270	18 298	18 327	18 355	18 384	18 412	18 441
153	18 469	18 498	18 526	18 554	18 583	18 611	18 639	18 667	18 696	18 724
154	18 752	18 780	18 808	18 837	18 865	18 893	18 921	18 949	18 977	19 005
155	19 033	19 061	19 089	19 117	19 145	19 173	19 201	19 229	19 257	19 285
156	19 312	19 340	19 368	19 396	19 424	19 451	19 479	19 507	19 535	19 562
157	19 590	19 618	19 645	19 673	19 700	19 728	19 756	19 783	19 811	19 838
158	19 866	19 893	19 921	19 948	19 976	20 003	20 030	20 058	20 085	20 112
159	20 140	20 167	20 194	20 222	20 249	20 276	20 303	20 330	20 358	20 385
160	20 412	20 439	20 466	20 493	20 520	20 548	20 575	20 602	20 629	20 656
161	20 683	20 710	20 737	20 763	20 790	20 817	20 844	20 871	20 898	20 925
162	20 952	20 978	21 005	21 032	21 059	21 085	21 112	21 139	21 165	21 192
163	21 219	21 245	21 272	21 299	21 325	21 352	21 378	21 405	21 431	21 458
164	21 484	21 511	21 537	21 564	21 590	21 617	21 643	21 669	21 696	21 722
165	21 748	21 775	21 801	21 827	21 854	21 880	21 906	21 932	21 958	21 985
166	22 011	22 037	22 063	22 089	22 115	22 141	22 167	22 194	22 220	22 246
167	22 272	22 298	22 324	22 350	22 376	22 401	22 427	22 453	22 479	22 505
168	22 531	22 557	22 583	22 608	22 634	22 660	22 686	22 712	22 737	22 763
169	22 789	22 814	22 840	22 866	22 891	22 917	22 943	22 968	22 994	23 019
170	23 045	23 070	23 096	23 121	23 147	23 172	23 198	23 223	23 249	23 274
171	23 300	23 325	23 350	23 376	23 401	23 426	23 452	23 477	23 502	23 528
172	23 553	23 578	23 603	23 629	23 654	23 679	23 704	23 729	23 754	23 779
173	23 805	23 830	23 855	23 880	23 905	23 930	23 955	23 980	24 005	24 030
174	24 055	24 080	24 105	24 130	24 155	24 180	24 204	24 229	24 254	24 279
175	24 304	24 329	24 353	24 378	24 403	24 428	24 452	24 477	24 502	24 527
176	24 551	24 576	24 601	24 625	24 650	24 674	24 699	24 724	24 748	24 773
177	24 797	24 822	24 846	24 871	24 895	24 920	24 944	24 969	24 993	25 018
178	25 042	25 066	25 091	25 115	25 139	25 164	25 188	25 212	25 237	25 261
179	25 285	25 310	25 334	25 358	25 382	25 406	25 431	25 455	25 479	25 503
180	25 527	25 551	25 575	25 600	25 624	25 648	25 672	25 696	25 720	25 744
181	25 768	25 792	25 816	25 840	25 864	25 888	25 912	25 935	25 959	25 983
182	26 007	26 031	26 055	26 079	26 102	26 126	26 150	26 174	26 198	26 221
183	26 245	26 269	26 293	26 316	26 340	26 364	26 387	26 411	26 435	26 458
184	26 482	26 505	26 529	26 553	26 576	26 600	26 623	26 647	26 670	26 694
185	26 717	26 741	26 764	26 788	26 811	26 834	26 858	26 881	26 905	26 928
186	26 951	26 975	26 998	27 021	27 045	27 068	27 091	27 114	27 138	27 161
187	27 184	27 207	27 231	27 254	27 277	27 300	27 323	27 346	27 370	27 393
188	27 416	27 439	27 462	27 485	27 508	27 531	27 554	27 577	27 600	27 623
189	27 646	27 669	27 692	27 715	27 738	27 761	27 784	27 807	27 830	27 852
190	27 875	27 898	27 921	27 944	27 967	27 989	28 012	28 035	28 058	28 081
191	28 103	28 126	28 149	28 171	28 194	28 217	28 240	28 262	28 285	28 307
192	28 330	28 353	28 375	28 398	28 421	28 443	28 466	28 488	28 511	28 533
193	28 556	28 578	28 601	28 623	28 646	28 668	28 691	28 713	28 735	28 758
194	28 780	28 803	28 825	28 847	28 870	28 892	28 914	28 937	28 959	28 981
195	29 003	29 026	29 048	29 070	29 092	29 115	29 137	29 159	29 181	29 203
196	29 226	29 248	29 270	29 292	29 314	29 336	29 358	29 380	29 403	29 425
197	29 447	29 469	29 491	29 513	29 535	29 557	29 579	29 601	29 623	29 645
198	29 667	29 688	29 710	29 732	29 754	29 776	29 798	29 820	29 842	29 863
199	29 885	29 907	29 929	29 951	29 973	29 994	30 016	30 038	30 060	30 081
200	30 103	30 125	30 146	30 168	30 190	30 211	30 233	30 255	30 276	30 298
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150 — 200

200—250

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201	30 320	30 341	30 363	30 384	30 406	30 428	30 449	30 471	30 492	30 514
202	30 535	30 557	30 578	30 600	30 621	30 643	30 664	30 685	30 707	30 728
203	30 750	30 771	30 792	30 814	30 835	30 856	30 878	30 899	30 920	30 942
204	30 963	30 984	31 006	31 027	31 048	31 069	31 091	31 112	31 133	31 154
205	31 175	31 197	31 218	31 239	31 260	31 281	31 302	31 323	31 345	31 366
206	31 387	31 408	31 429	31 450	31 471	31 492	31 513	31 534	31 555	31 576
207	31 597	31 618	31 639	31 660	31 681	31 702	31 723	31 744	31 765	31 785
208	31 806	31 827	31 848	31 869	31 890	31 911	31 931	31 952	31 973	31 994
209	32 015	32 035	32 056	32 077	32 098	32 118	32 139	32 160	32 181	32 201
210	32 222	32 243	32 263	32 284	32 305	32 325	32 346	32 366	32 387	32 408
211	32 428	32 449	32 469	32 490	32 510	32 531	32 552	32 572	32 593	32 613
212	32 634	32 654	32 675	32 695	32 715	32 736	32 756	32 777	32 797	32 818
213	32 838	32 858	32 879	32 899	32 919	32 940	32 960	32 980	33 001	33 021
214	33 041	33 062	33 082	33 102	33 122	33 143	33 163	33 183	33 203	33 224
215	33 244	33 264	33 284	33 304	33 325	33 345	33 365	33 385	33 405	33 425
216	33 445	33 465	33 486	33 506	33 526	33 546	33 566	33 586	33 606	33 626
217	33 646	33 666	33 686	33 706	33 726	33 746	33 766	33 786	33 806	33 826
218	33 846	33 866	33 885	33 905	33 925	33 945	33 965	33 985	34 005	34 025
219	34 044	34 064	34 084	34 104	34 124	34 143	34 163	34 183	34 203	34 223
220	34 242	34 262	34 282	34 301	34 321	34 341	34 361	34 380	34 400	34 420
221	34 439	34 459	34 479	34 498	34 518	34 537	34 557	34 577	34 596	34 616
222	34 635	34 655	34 674	34 694	34 713	34 733	34 753	34 772	34 792	34 811
223	34 830	34 850	34 869	34 889	34 908	34 928	34 947	34 967	34 986	35 005
224	35 025	35 044	35 064	35 083	35 102	35 122	35 141	35 160	35 180	35 199
225	35 218	35 238	35 257	35 276	35 295	35 315	35 334	35 353	35 372	35 392
226	35 411	35 430	35 449	35 468	35 488	35 507	35 526	35 545	35 564	35 583
227	35 603	35 622	35 641	35 660	35 679	35 698	35 717	35 736	35 755	35 774
228	35 793	35 813	35 832	35 851	35 870	35 889	35 908	35 927	35 946	35 965
229	35 984	36 003	36 021	36 040	36 059	36 078	36 097	36 116	36 135	36 154
230	36 173	36 192	36 211	36 229	36 248	36 267	36 286	36 305	36 324	36 342
231	36 361	36 380	36 399	36 418	36 436	36 455	36 474	36 493	36 511	36 530
232	36 549	36 568	36 586	36 605	36 624	36 642	36 661	36 680	36 698	36 717
233	36 736	36 754	36 773	36 791	36 810	36 829	36 847	36 866	36 884	36 903
234	36 922	36 940	36 959	36 977	36 996	37 014	37 033	37 051	37 070	37 088
235	37 107	37 125	37 144	37 162	37 181	37 199	37 218	37 236	37 254	37 273
236	37 291	37 310	37 328	37 346	37 365	37 383	37 401	37 420	37 438	37 457
237	37 475	37 493	37 511	37 530	37 548	37 566	37 585	37 603	37 621	37 639
238	37 658	37 676	37 694	37 712	37 731	37 749	37 767	37 785	37 803	37 822
239	37 840	37 858	37 876	37 894	37 912	37 931	37 949	37 967	37 985	38 003
240	38 021	38 039	38 057	38 075	38 093	38 112	38 130	38 148	38 166	38 184
241	38 202	38 220	38 238	38 256	38 274	38 292	38 310	38 328	38 346	38 364
242	38 382	38 399	38 417	38 435	38 453	38 471	38 489	38 507	38 525	38 543
243	38 561	38 578	38 596	38 614	38 632	38 650	38 668	38 686	38 703	38 721
244	38 739	38 757	38 775	38 792	38 810	38 828	38 846	38 863	38 881	38 899
245	38 917	38 934	38 952	38 970	38 987	39 005	39 023	39 041	39 058	39 076
246	39 094	39 111	39 129	39 146	39 164	39 182	39 199	39 217	39 235	39 252
247	39 270	39 287	39 305	39 322	39 340	39 358	39 375	39 393	39 410	39 428
248	39 445	39 463	39 480	39 498	39 515	39 533	39 550	39 568	39 585	39 602
249	39 620	39 637	39 655	39 672	39 690	39 707	39 724	39 742	39 759	39 777
250	39 794	39 811	39 829	39 846	39 863	39 881	39 898	39 915	39 933	39 950

N 0 1 2 3 4 5 6 7 8 9

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250	39 794	39 811	39 829	39 846	39 863	39 881	39 898	39 915	39 933	39 950
251	39 967	39 985	40 002	40 019	40 037	40 054	40 071	40 088	40 106	40 123
252	40 140	40 157	40 175	40 192	40 209	40 226	40 243	40 261	40 278	40 295
253	40 312	40 329	40 346	40 364	40 381	40 398	40 415	40 432	40 449	40 466
254	40 483	40 500	40 518	40 535	40 552	40 569	40 586	40 603	40 620	40 637
255	40 654	40 671	40 688	40 705	40 722	40 739	40 756	40 773	40 790	40 807
256	40 824	40 841	40 858	40 875	40 892	40 909	40 926	40 943	40 960	40 976
257	40 993	41 010	41 027	41 044	41 061	41 078	41 095	41 111	41 128	41 145
258	41 162	41 179	41 196	41 212	41 229	41 246	41 263	41 280	41 296	41 313
259	41 330	41 347	41 363	41 380	41 397	41 414	41 430	41 447	41 464	41 481
260	41 497	41 514	41 531	41 547	41 564	41 581	41 597	41 614	41 631	41 647
261	41 664	41 681	41 697	41 714	41 731	41 747	41 764	41 780	41 797	41 814
262	41 830	41 847	41 863	41 880	41 896	41 913	41 929	41 946	41 963	41 979
263	41 996	42 012	42 029	42 045	42 062	42 078	42 095	42 111	42 127	42 144
264	42 160	42 177	42 193	42 210	42 226	42 243	42 259	42 275	42 292	42 308
265	42 325	42 341	42 357	42 374	42 390	42 406	42 423	42 439	42 455	42 472
266	42 488	42 504	42 521	42 537	42 553	42 570	42 586	42 602	42 619	42 635
267	42 651	42 667	42 684	42 700	42 716	42 732	42 749	42 765	42 781	42 797
268	42 813	42 830	42 846	42 862	42 878	42 894	42 911	42 927	42 943	42 959
269	42 975	42 991	43 008	43 024	43 040	43 056	43 072	43 088	43 104	43 120
270	43 136	43 152	43 169	43 185	43 201	43 217	43 233	43 249	43 265	43 281
271	43 297	43 313	43 329	43 345	43 361	43 377	43 393	43 409	43 425	43 441
272	43 457	43 473	43 489	43 505	43 521	43 537	43 553	43 569	43 584	43 600
273	43 616	43 632	43 648	43 664	43 680	43 696	43 712	43 727	43 743	43 759
274	43 775	43 791	43 807	43 823	43 838	43 854	43 870	43 886	43 902	43 917
275	43 933	43 949	43 965	43 981	43 996	44 012	44 028	44 044	44 059	44 075
276	44 091	44 107	44 122	44 138	44 154	44 170	44 185	44 201	44 217	44 232
277	44 248	44 264	44 279	44 295	44 311	44 326	44 342	44 358	44 373	44 389
278	44 404	44 420	44 436	44 451	44 467	44 483	44 498	44 514	44 529	44 545
279	44 560	44 576	44 592	44 607	44 623	44 638	44 654	44 669	44 685	44 700
280	44 716	44 731	44 747	44 762	44 778	44 793	44 809	44 824	44 840	44 855
281	44 871	44 886	44 902	44 917	44 932	44 948	44 963	44 979	44 994	45 010
282	45 025	45 040	45 056	45 071	45 086	45 102	45 117	45 133	45 148	45 163
283	45 179	45 194	45 209	45 225	45 240	45 255	45 271	45 286	45 301	45 317
284	45 332	45 347	45 362	45 378	45 393	45 408	45 423	45 439	45 454	45 469
285	45 484	45 500	45 515	45 530	45 545	45 561	45 576	45 591	45 606	45 621
286	45 637	45 652	45 667	45 682	45 697	45 712	45 728	45 743	45 758	45 773
287	45 788	45 803	45 818	45 834	45 849	45 864	45 879	45 894	45 909	45 924
288	45 939	45 954	45 969	45 984	46 000	46 015	46 030	46 045	46 060	46 075
289	46 090	46 105	46 120	46 135	46 150	46 165	46 180	46 195	46 210	46 225
290	46 240	46 255	46 270	46 285	46 300	46 315	46 330	46 345	46 359	46 374
291	46 389	46 404	46 419	46 434	46 449	46 464	46 479	46 494	46 509	46 523
292	46 538	46 553	46 568	46 583	46 598	46 613	46 627	46 642	46 657	46 672
293	46 687	46 702	46 716	46 731	46 746	46 761	46 776	46 790	46 805	46 820
294	46 835	46 850	46 864	46 879	46 894	46 909	46 923	46 938	46 953	46 967
295	46 982	46 997	47 012	47 026	47 041	47 056	47 070	47 085	47 100	47 114
296	47 129	47 144	47 159	47 173	47 188	47 202	47 217	47 232	47 246	47 261
297	47 276	47 290	47 305	47 319	47 334	47 349	47 363	47 378	47 392	47 407
298	47 422	47 436	47 451	47 465	47 480	47 494	47 509	47 524	47 538	47 553
299	47 567	47 582	47 596	47 611	47 625	47 640	47 654	47 669	47 683	47 698
300	47 712	47 727	47 741	47 756	47 770	47 784	47 799	47 813	47 828	47 842

300—350

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300	47 712	47 727	47 741	47 756	47 770	47 784	47 799	47 813	47 828	47 842
301	47 857	47 871	47 885	47 900	47 914	47 929	47 943	47 958	47 972	47 986
302	48 001	48 015	48 029	48 044	48 058	48 073	48 087	48 101	48 116	48 130
303	48 144	48 159	48 173	48 187	48 202	48 216	48 230	48 244	48 259	48 273
304	48 287	48 302	48 316	48 330	48 344	48 359	48 373	48 387	48 401	48 416
305	48 430	48 444	48 458	48 473	48 487	48 501	48 515	48 530	48 544	48 558
306	48 572	48 586	48 601	48 615	48 629	48 643	48 657	48 671	48 686	48 700
307	48 714	48 728	48 742	48 756	48 770	48 785	48 799	48 813	48 827	48 841
308	48 855	48 869	48 883	48 897	48 911	48 926	48 940	48 954	48 968	48 982
309	48 996	49 010	49 024	49 038	49 052	49 066	49 080	49 094	49 108	49 122
310	49 136	49 150	49 164	49 178	49 192	49 206	49 220	49 234	49 248	49 262
311	49 276	49 290	49 304	49 318	49 332	49 346	49 360	49 374	49 388	49 402
312	49 415	49 429	49 443	49 457	49 471	49 485	49 499	49 513	49 527	49 541
313	49 554	49 568	49 582	49 596	49 610	49 624	49 638	49 651	49 665	49 679
314	49 693	49 707	49 721	49 734	49 748	49 762	49 776	49 790	49 803	49 817
315	49 831	49 845	49 859	49 872	49 886	49 900	49 914	49 927	49 941	49 955
316	49 969	49 982	49 996	50 010	50 024	50 037	50 051	50 065	50 079	50 092
317	50 106	50 120	50 133	50 147	50 161	50 174	50 188	50 202	50 215	50 229
318	50 243	50 256	50 270	50 284	50 297	50 311	50 325	50 338	50 352	50 365
319	50 379	50 393	50 406	50 420	50 433	50 447	50 461	50 474	50 488	50 501
320	50 515	50 529	50 542	50 556	50 569	50 583	50 596	50 610	50 623	50 637
321	50 651	50 664	50 678	50 691	50 705	50 718	50 732	50 745	50 759	50 772
322	50 786	50 799	50 813	50 826	50 840	50 853	50 866	50 880	50 893	50 907
323	50 920	50 934	50 947	50 961	50 974	50 987	51 001	51 014	51 028	51 041
324	51 055	51 068	51 081	51 095	51 108	51 121	51 135	51 148	51 162	51 175
325	51 188	51 202	51 215	51 228	51 242	51 255	51 268	51 282	51 295	51 308
326	51 322	51 335	51 348	51 362	51 375	51 388	51 402	51 415	51 428	51 441
327	51 455	51 468	51 481	51 495	51 508	51 521	51 534	51 548	51 561	51 574
328	51 587	51 601	51 614	51 627	51 640	51 654	51 667	51 680	51 693	51 706
329	51 720	51 733	51 746	51 759	51 772	51 786	51 799	51 812	51 825	51 838
330	51 851	51 865	51 878	51 891	51 904	51 917	51 930	51 943	51 957	51 970
331	51 983	51 996	52 009	52 022	52 035	52 048	52 061	52 075	52 088	52 101
332	52 114	52 127	52 140	52 153	52 166	52 179	52 192	52 205	52 218	52 231
333	52 244	52 257	52 270	52 284	52 297	52 310	52 323	52 336	52 349	52 362
334	52 375	52 388	52 401	52 414	52 427	52 440	52 453	52 466	52 479	52 492
335	52 504	52 517	52 530	52 543	52 556	52 569	52 582	52 595	52 608	52 621
336	52 634	52 647	52 660	52 673	52 686	52 699	52 711	52 724	52 737	52 750
337	52 763	52 776	52 789	52 802	52 815	52 827	52 840	52 853	52 866	52 879
338	52 892	52 905	52 917	52 930	52 943	52 956	52 969	52 982	52 994	53 007
339	53 020	53 033	53 046	53 058	53 071	53 084	53 097	53 110	53 122	53 135
340	53 148	53 161	53 173	53 186	53 199	53 212	53 224	53 237	53 250	53 263
341	53 275	53 288	53 301	53 314	53 326	53 339	53 352	53 364	53 377	53 390
342	53 403	53 415	53 428	53 441	53 453	53 466	53 479	53 491	53 504	53 517
343	53 529	53 542	53 555	53 567	53 580	53 593	53 605	53 618	53 631	53 643
344	53 656	53 668	53 681	53 694	53 706	53 719	53 732	53 744	53 757	53 769
345	53 782	53 794	53 807	53 820	53 832	53 845	53 857	53 870	53 882	53 895
346	53 908	53 920	53 933	53 945	53 958	53 970	53 983	53 995	54 008	54 020
347	54 033	54 045	54 058	54 070	54 083	54 095	54 108	54 120	54 133	54 145
348	54 158	54 170	54 183	54 195	54 208	54 220	54 233	54 245	54 258	54 270
349	54 283	54 295	54 307	54 320	54 332	54 345	54 357	54 370	54 382	54 394
350	54 407	54 419	54 432	54 444	54 456	54 469	54 481	54 494	54 506	54 518

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350	54 407	54 419	54 432	54 444	54 456	54 469	54 481	54 494	54 506	54 518
351	54 531	54 543	54 555	54 568	54 580	54 593	54 605	54 617	54 630	54 642
352	54 654	54 667	54 679	54 691	54 704	54 716	54 728	54 741	54 753	54 765
353	54 777	54 790	54 802	54 814	54 827	54 839	54 851	54 864	54 876	54 888
354	54 900	54 913	54 925	54 937	54 949	54 962	54 974	54 986	54 998	55 011
355	55 023	55 035	55 047	55 060	55 072	55 084	55 096	55 108	55 121	55 133
356	55 145	55 157	55 169	55 182	55 194	55 206	55 218	55 230	55 242	55 255
357	55 267	55 279	55 291	55 303	55 315	55 328	55 340	55 352	55 364	55 376
358	55 388	55 400	55 413	55 425	55 437	55 449	55 461	55 473	55 485	55 497
359	55 509	55 522	55 534	55 546	55 558	55 570	55 582	55 594	55 606	55 618
360	55 630	55 642	55 654	55 666	55 678	55 691	55 703	55 715	55 727	55 739
361	55 751	55 763	55 775	55 787	55 799	55 811	55 823	55 835	55 847	55 859
362	55 871	55 883	55 895	55 907	55 919	55 931	55 943	55 955	55 967	55 979
363	55 991	56 003	56 015	56 027	56 038	56 050	56 062	56 074	56 086	56 098
364	56 110	56 122	56 134	56 146	56 158	56 170	56 182	56 194	56 205	56 217
365	56 229	56 241	56 253	56 265	56 277	56 289	56 301	56 312	56 324	56 336
366	56 348	56 360	56 372	56 384	56 396	56 407	56 419	56 431	56 443	56 455
367	56 467	56 478	56 490	56 502	56 514	56 526	56 538	56 549	56 561	56 573
368	56 585	56 597	56 608	56 620	56 632	56 644	56 656	56 667	56 679	56 691
369	56 703	56 714	56 726	56 738	56 750	56 761	56 773	56 785	56 797	56 808
370	56 820	56 832	56 844	56 855	56 867	56 879	56 891	56 902	56 914	56 926
371	56 937	56 949	56 961	56 972	56 984	56 996	57 008	57 019	57 031	57 043
372	57 054	57 066	57 078	57 089	57 101	57 113	57 124	57 136	57 148	57 159
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423	62 634	62 644	62 655	62 665	62 675	62 685	62 696	62 706	62 716	62 726
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446	64 933	64 943	64 953	64 963	64 972	64 982	64 992	65 002	65 011	65 021
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448	65 128	65 137	65 147	65 157	65 167	65 176	65 186	65 196	65 205	65 215
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451	65 418	65 427	65 437	65 447	65 456	65 466	65 475	65 485	65 495	65 504
452	65 514	65 523	65 533	65 543	65 552	65 562	65 571	65 581	65 591	65 600
453	65 610	65 619	65 629	65 639	65 648	65 658	65 667	65 677	65 686	65 696
454	65 706	65 715	65 725	65 734	65 744	65 753	65 763	65 772	65 782	65 792
455	65 801	65 811	65 820	65 830	65 839	65 849	65 858	65 868	65 877	65 887
456	65 896	65 906	65 916	65 925	65 935	65 944	65 954	65 963	65 973	65 982
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492	69 197	69 205	69 214	69 223	69 232	69 241	69 249	69 258	69 267	69 276
493	69 285	69 294	69 302	69 311	69 320	69 329	69 338	69 346	69 355	69 364
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503	70 157	70 165	70 174	70 183	70 191	70 200	70 209	70 217	70 226	70 234
504	70 243	70 252	70 260	70 269	70 278	70 286	70 295	70 303	70 312	70 321
505	70 329	70 338	70 346	70 355	70 364	70 372	70 381	70 389	70 398	70 406
506	70 415	70 424	70 432	70 441	70 449	70 458	70 467	70 475	70 484	70 492
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554	74 351	74 359	74 367	74 374	74 382	74 390	74 398	74 406	74 414	74 421
555	74 429	74 437	74 445	74 453	74 461	74 468	74 476	74 484	74 492	74 500
556	74 507	74 515	74 523	74 531	74 539	74 547	74 554	74 562	74 570	74 578
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568	75 435	75 442	75 450	75 458	75 465	75 473	75 481	75 488	75 496	75 504
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574	75 891	75 899	75 906	75 914	75 921	75 929	75 937	75 944	75 952	75 959
575	75 967	75 974	75 982	75 989	75 997	76 005	76 012	76 020	76 027	76 035
576	76 042	76 050	76 057	76 065	76 072	76 080	76 087	76 095	76 103	76 110
577	76 118	76 125	76 133	76 140	76 148	76 155	76 163	76 170	76 178	76 185
578	76 193	76 200	76 208	76 215	76 223	76 230	76 238	76 245	76 253	76 260
579	76 268	76 275	76 283	76 290	76 298	76 305	76 313	76 320	76 328	76 335
580	76 343	76 350	76 358	76 365	76 373	76 380	76 388	76 395	76 403	76 410
581	76 418	76 425	76 433	76 440	76 448	76 455	76 462	76 470	76 477	76 485
582	76 492	76 500	76 507	76 515	76 522	76 530	76 537	76 545	76 552	76 559
583	76 567	76 574	76 582	76 589	76 597	76 604	76 612	76 619	76 626	76 634
584	76 641	76 649	76 656	76 664	76 671	76 678	76 686	76 693	76 701	76 708
585	76 716	76 723	76 730	76 738	76 745	76 753	76 760	76 768	76 775	76 782
586	76 790	76 797	76 805	76 812	76 819	76 827	76 834	76 842	76 849	76 856
587	76 864	76 871	76 879	76 886	76 893	76 901	76 908	76 916	76 923	76 930
588	76 938	76 945	76 953	76 960	76 967	76 975	76 982	76 989	76 997	77 004
589	77 012	77 019	77 026	77 034	77 041	77 048	77 056	77 063	77 070	77 078
590	77 085	77 093	77 100	77 107	77 115	77 122	77 129	77 137	77 144	77 151
591	77 159	77 166	77 173	77 181	77 188	77 195	77 203	77 210	77 217	77 225
592	77 232	77 240	77 247	77 254	77 262	77 269	77 276	77 283	77 291	77 298
593	77 305	77 313	77 320	77 327	77 335	77 342	77 349	77 357	77 364	77 371
594	77 379	77 386	77 393	77 401	77 408	77 415	77 422	77 430	77 437	77 444
595	77 452	77 459	77 466	77 474	77 481	77 488	77 495	77 503	77 510	77 517
596	77 525	77 532	77 539	77 546	77 554	77 561	77 568	77 576	77 583	77 590
597	77 597	77 605	77 612	77 619	77 627	77 634	77 641	77 648	77 656	77 663
598	77 670	77 677	77 685	77 692	77 699	77 706	77 714	77 721	77 728	77 735
599	77 743	77 750	77 757	77 764	77 772	77 779	77 786	77 793	77 801	77 808
600	77 815	77 822	77 830	77 837	77 844	77 851	77 859	77 866	77 873	77 880

N 0 1 2 3 4 5 6 7 8 9

600—650

N	0	1	2	3	4	5	6	7	8	9
600	77 815	77 822	77 830	77 837	77 844	77 851	77 859	77 866	77 873	77 880
601	77 887	77 895	77 902	77 909	77 916	77 924	77 931	77 938	77 945	77 952
602	77 960	77 967	77 974	77 981	77 988	77 996	78 003	78 010	78 017	78 025
603	78 032	78 039	78 046	78 053	78 061	78 068	78 075	78 082	78 089	78 097
604	78 104	78 111	78 118	78 125	78 132	78 140	78 147	78 154	78 161	78 168
605	78 176	78 183	78 190	78 197	78 204	78 211	78 219	78 226	78 233	78 240
606	78 247	78 254	78 262	78 269	78 276	78 283	78 290	78 297	78 305	78 312
607	78 319	78 326	78 333	78 340	78 347	78 355	78 362	78 369	78 376	78 383
608	78 390	78 398	78 405	78 412	78 419	78 426	78 433	78 440	78 447	78 455
609	78 462	78 469	78 476	78 483	78 490	78 497	78 504	78 512	78 519	78 526
610	78 533	78 540	78 547	78 554	78 561	78 569	78 576	78 583	78 590	78 597
611	78 604	78 611	78 618	78 625	78 633	78 640	78 647	78 654	78 661	78 668
612	78 675	78 682	78 689	78 696	78 704	78 711	78 718	78 725	78 732	78 739
613	78 746	78 753	78 760	78 767	78 774	78 781	78 789	78 796	78 803	78 810
614	78 817	78 824	78 831	78 838	78 845	78 852	78 859	78 866	78 873	78 880
615	78 888	78 895	78 902	78 909	78 916	78 923	78 930	78 937	78 944	78 951
616	78 958	78 965	78 972	78 979	78 986	78 993	79 000	79 007	79 014	79 021
617	79 029	79 036	79 043	79 050	79 057	79 064	79 071	79 078	79 085	79 092
618	79 099	79 106	79 113	79 120	79 127	79 134	79 141	79 148	79 155	79 162
619	79 169	79 176	79 183	79 190	79 197	79 204	79 211	79 218	79 225	79 232
620	79 239	79 246	79 253	79 260	79 267	79 274	79 281	79 288	79 295	79 302
621	79 309	79 316	79 323	79 330	79 337	79 344	79 351	79 358	79 365	79 372
622	79 379	79 386	79 393	79 400	79 407	79 414	79 421	79 428	79 435	79 442
623	79 449	79 456	79 463	79 470	79 477	79 484	79 491	79 498	79 505	79 511
624	79 518	79 525	79 532	79 539	79 546	79 553	79 560	79 567	79 574	79 581
625	79 588	79 595	79 602	79 609	79 616	79 623	79 630	79 637	79 644	79 650
626	79 657	79 664	79 671	79 678	79 685	79 692	79 699	79 706	79 713	79 720
627	79 727	79 734	79 741	79 748	79 754	79 761	79 768	79 775	79 782	79 789
628	79 796	79 803	79 810	79 817	79 824	79 831	79 837	79 844	79 851	79 858
629	79 865	79 872	79 879	79 886	79 893	79 900	79 906	79 913	79 920	79 927
630	79 934	79 941	79 948	79 955	79 962	79 969	79 975	79 982	79 989	79 996
631	80 003	80 010	80 017	80 024	80 030	80 037	80 044	80 051	80 058	80 065
632	80 072	80 079	80 085	80 092	80 099	80 106	80 113	80 120	80 127	80 134
633	80 140	80 147	80 154	80 161	80 168	80 175	80 182	80 188	80 195	80 202
634	80 209	80 216	80 223	80 229	80 236	80 243	80 250	80 257	80 264	80 271
635	80 277	80 284	80 291	80 298	80 305	80 312	80 318	80 325	80 332	80 339
636	80 346	80 353	80 359	80 366	80 373	80 380	80 387	80 393	80 400	80 407
637	80 414	80 421	80 428	80 434	80 441	80 448	80 455	80 462	80 468	80 475
638	80 482	80 489	80 496	80 502	80 509	80 516	80 523	80 530	80 536	80 543
639	80 550	80 557	80 564	80 570	80 577	80 584	80 591	80 598	80 604	80 611
640	80 618	80 625	80 632	80 638	80 645	80 652	80 659	80 665	80 672	80 679
641	80 686	80 693	80 699	80 706	80 713	80 720	80 726	80 733	80 740	80 747
642	80 754	80 760	80 767	80 774	80 781	80 787	80 794	80 801	80 808	80 814
643	80 821	80 828	80 835	80 841	80 848	80 855	80 862	80 868	80 875	80 882
644	80 889	80 895	80 902	80 909	80 916	80 922	80 929	80 936	80 943	80 949
645	80 956	80 963	80 969	80 976	80 983	80 990	80 996	81 003	81 010	81 017
646	81 023	81 030	81 037	81 043	81 050	81 057	81 064	81 070	81 077	81 084
647	81 090	81 097	81 104	81 111	81 117	81 124	81 131	81 137	81 144	81 151
648	81 158	81 164	81 171	81 178	81 184	81 191	81 198	81 204	81 211	81 218
649	81 224	81 231	81 238	81 245	81 251	81 258	81 265	81 271	81 278	81 285
650	81 291	81 298	81 305	81 311	81 318	81 325	81 331	81 338	81 345	81 351

N 0 1 2 3 4 5 6 7 8 9

N	0	1	2	3	4	5	6	7	8	9
650	81 291	81 298	81 305	81 311	81 318	81 325	81 331	81 338	81 345	81 351
651	81 358	81 365	81 371	81 378	81 385	81 391	81 398	81 405	81 411	81 418
652	81 425	81 431	81 438	81 445	81 451	81 458	81 465	81 471	81 478	81 485
653	81 491	81 498	81 505	81 511	81 518	81 525	81 531	81 538	81 544	81 551
654	81 558	81 564	81 571	81 578	81 584	81 591	81 598	81 604	81 611	81 617
655	81 624	81 631	81 637	81 644	81 651	81 657	81 664	81 671	81 677	81 684
656	81 690	81 697	81 704	81 710	81 717	81 723	81 730	81 737	81 743	81 750
657	81 757	81 763	81 770	81 776	81 783	81 790	81 796	81 803	81 809	81 816
658	81 823	81 829	81 836	81 842	81 849	81 856	81 862	81 869	81 875	81 882
659	81 889	81 895	81 902	81 908	81 915	81 921	81 928	81 935	81 941	81 948
660	81 954	81 961	81 968	81 974	81 981	81 987	81 994	82 000	82 007	82 014
661	82 020	82 027	82 033	82 040	82 046	82 053	82 060	82 066	82 073	82 079
662	82 086	82 092	82 099	82 105	82 112	82 119	82 125	82 132	82 138	82 145
663	82 151	82 158	82 164	82 171	82 178	82 184	82 191	82 197	82 204	82 210
664	82 217	82 223	82 230	82 236	82 243	82 249	82 256	82 263	82 269	82 276
665	82 282	82 289	82 295	82 302	82 308	82 315	82 321	82 328	82 334	82 341
666	82 347	82 354	82 360	82 367	82 373	82 380	82 387	82 393	82 400	82 406
667	82 413	82 419	82 426	82 432	82 439	82 445	82 452	82 458	82 465	82 471
668	82 478	82 484	82 491	82 497	82 504	82 510	82 517	82 523	82 530	82 536
669	82 543	82 549	82 556	82 562	82 569	82 575	82 582	82 588	82 595	82 601
670	82 607	82 614	82 620	82 627	82 633	82 640	82 646	82 653	82 659	82 666
671	82 672	82 679	82 685	82 692	82 698	82 705	82 711	82 718	82 724	82 730
672	82 737	82 743	82 750	82 756	82 763	82 769	82 776	82 782	82 789	82 795
673	82 802	82 808	82 814	82 821	82 827	82 834	82 840	82 847	82 853	82 860
674	82 866	82 872	82 879	82 885	82 892	82 898	82 905	82 911	82 918	82 924
675	82 930	82 937	82 943	82 950	82 956	82 963	82 969	82 975	82 982	82 988
676	82 995	83 001	83 008	83 014	83 020	83 027	83 033	83 040	83 046	83 052
677	83 059	83 065	83 072	83 078	83 085	83 091	83 097	83 104	83 110	83 117
678	83 123	83 129	83 136	83 142	83 149	83 155	83 161	83 168	83 174	83 181
679	83 187	83 193	83 200	83 206	83 213	83 219	83 225	83 232	83 238	83 245
680	83 251	83 257	83 264	83 270	83 276	83 283	83 289	83 296	83 302	83 308
681	83 315	83 321	83 327	83 334	83 340	83 347	83 353	83 359	83 366	83 372
682	83 378	83 385	83 391	83 398	83 404	83 410	83 417	83 423	83 429	83 436
683	83 442	83 448	83 455	83 461	83 467	83 474	83 480	83 487	83 493	83 499
684	83 506	83 512	83 518	83 525	83 531	83 537	83 544	83 550	83 556	83 563
685	83 569	83 575	83 582	83 588	83 594	83 601	83 607	83 613	83 620	83 626
686	83 632	83 639	83 645	83 651	83 658	83 664	83 670	83 677	83 683	83 689
687	83 696	83 702	83 708	83 715	83 721	83 727	83 734	83 740	83 746	83 753
688	83 759	83 765	83 771	83 778	83 784	83 790	83 797	83 803	83 809	83 816
689	83 822	83 828	83 835	83 841	83 847	83 853	83 860	83 866	83 872	83 879
690	83 885	83 891	83 897	83 904	83 910	83 916	83 923	83 929	83 935	83 942
691	83 948	83 954	83 960	83 967	83 973	83 979	83 985	83 992	83 998	84 004
692	84 011	84 017	84 023	84 029	84 036	84 042	84 048	84 055	84 061	84 067
693	84 073	84 080	84 086	84 092	84 098	84 105	84 111	84 117	84 123	84 130
694	84 136	84 142	84 148	84 155	84 161	84 167	84 173	84 180	84 186	84 192
695	84 198	84 205	84 211	84 217	84 223	84 230	84 236	84 242	84 248	84 255
696	84 261	84 267	84 273	84 280	84 286	84 292	84 298	84 305	84 311	84 317
697	84 323	84 330	84 336	84 342	84 348	84 354	84 361	84 367	84 373	84 379
698	84 386	84 392	84 398	84 404	84 410	84 417	84 423	84 429	84 435	84 442
699	84 448	84 454	84 460	84 466	84 473	84 479	84 485	84 491	84 497	84 504
700	84 510	84 516	84 522	84 528	84 535	84 541	84 547	84 553	84 559	84 566
N	0	1	2	3	4	5	6	7	8	9

700—750

N	0	1	2	3	4	5	6	7	8	9
700	84 510	84 516	84 522	84 528	84 535	84 541	84 547	84 553	84 559	84 566
701	84 572	84 578	84 584	84 590	84 597	84 603	84 609	84 615	84 621	84 628
702	84 634	84 640	84 646	84 652	84 658	84 665	84 671	84 677	84 683	84 689
703	84 696	84 702	84 708	84 714	84 720	84 726	84 733	84 739	84 745	84 751
704	84 757	84 763	84 770	84 776	84 782	84 788	84 794	84 800	84 807	84 813
705	84 819	84 825	84 831	84 837	84 844	84 850	84 856	84 862	84 868	84 874
706	84 880	84 887	84 893	84 899	84 905	84 911	84 917	84 924	84 930	84 936
707	84 942	84 948	84 954	84 960	84 967	84 973	84 979	84 985	84 991	84 997
708	85 003	85 009	85 016	85 022	85 028	85 034	85 040	85 046	85 052	85 058
709	85 065	85 071	85 077	85 083	85 089	85 095	85 101	85 107	85 114	85 120
710	85 126	85 132	85 138	85 144	85 150	85 156	85 163	85 169	85 175	85 181
711	85 187	85 193	85 199	85 205	85 211	85 217	85 224	85 230	85 236	85 242
712	85 248	85 254	85 260	85 266	85 272	85 278	85 285	85 291	85 297	85 303
713	85 309	85 315	85 321	85 327	85 333	85 339	85 345	85 352	85 358	85 364
714	85 370	85 376	85 382	85 388	85 394	85 400	85 406	85 412	85 418	85 425
715	85 431	85 437	85 443	85 449	85 455	85 461	85 467	85 473	85 479	85 485
716	85 491	85 497	85 503	85 509	85 516	85 522	85 528	85 534	85 540	85 546
717	85 552	85 558	85 564	85 570	85 576	85 582	85 588	85 594	85 600	85 606
718	85 612	85 618	85 625	85 631	85 637	85 643	85 649	85 655	85 661	85 667
719	85 673	85 679	85 685	85 691	85 697	85 703	85 709	85 715	85 721	85 727
720	85 733	85 739	85 745	85 751	85 757	85 763	85 769	85 775	85 781	85 788
721	85 794	85 800	85 806	85 812	85 818	85 824	85 830	85 836	85 842	85 848
722	85 854	85 860	85 866	85 872	85 878	85 884	85 890	85 896	85 902	85 908
723	85 914	85 920	85 926	85 932	85 938	85 944	85 950	85 956	85 962	85 968
724	85 974	85 980	85 986	85 992	85 998	86 004	86 010	86 016	86 022	86 028
725	86 034	86 040	86 046	86 052	86 058	86 064	86 070	86 076	86 082	86 088
726	86 094	86 100	86 106	86 112	86 118	86 124	86 130	86 136	86 141	86 147
727	86 153	86 159	86 165	86 171	86 177	86 183	86 189	86 195	86 201	86 207
728	86 213	86 219	86 225	86 231	86 237	86 243	86 249	86 255	86 261	86 267
729	86 273	86 279	86 285	86 291	86 297	86 303	86 308	86 314	86 320	86 326
730	86 332	86 338	86 344	86 350	86 356	86 362	86 368	86 374	86 380	86 386
731	86 392	86 398	86 404	86 410	86 415	86 421	86 427	86 433	86 439	86 445
732	86 451	86 457	86 463	86 469	86 475	86 481	86 487	86 493	86 499	86 504
733	86 510	86 516	86 522	86 528	86 534	86 540	86 546	86 552	86 558	86 564
734	86 570	86 576	86 581	86 587	86 593	86 599	86 605	86 611	86 617	86 623
735	86 629	86 635	86 641	86 646	86 652	86 658	86 664	86 670	86 676	86 682
736	86 688	86 694	86 700	86 705	86 711	86 717	86 723	86 729	86 735	86 741
737	86 747	86 753	86 759	86 764	86 770	86 776	86 782	86 788	86 794	86 800
738	86 806	86 812	86 817	86 823	86 829	86 835	86 841	86 847	86 853	86 859
739	86 864	86 870	86 876	86 882	86 888	86 894	86 900	86 906	86 911	86 917
740	86 923	86 929	86 935	86 941	86 947	86 953	86 958	86 964	86 970	86 976
741	86 982	86 988	86 994	86 999	87 005	87 011	87 017	87 023	87 029	87 035
742	87 040	87 046	87 052	87 058	87 064	87 070	87 075	87 081	87 087	87 093
743	87 099	87 105	87 111	87 116	87 122	87 128	87 134	87 140	87 146	87 151
744	87 157	87 163	87 169	87 175	87 181	87 186	87 192	87 198	87 204	87 210
745	87 216	87 221	87 227	87 233	87 239	87 245	87 251	87 256	87 262	87 268
746	87 274	87 280	87 286	87 291	87 297	87 303	87 309	87 315	87 320	87 326
747	87 332	87 338	87 344	87 349	87 355	87 361	87 367	87 373	87 379	87 384
748	87 390	87 396	87 402	87 408	87 413	87 419	87 425	87 431	87 437	87 442
749	87 448	87 454	87 460	87 466	87 471	87 477	87 483	87 489	87 495	87 500
750	87 506	87 512	87 518	87 523	87 529	87 535	87 541	87 547	87 552	87 558

N 0 1 2 3 4 5 6 7 8 9

N	0	1	2	3	4	5	6	7	8	9
750	87 506	87 512	87 518	87 523	87 529	87 535	87 541	87 547	87 552	87 558
751	87 564	87 570	87 576	87 581	87 587	87 593	87 599	87 604	87 610	87 616
752	87 622	87 628	87 633	87 639	87 645	87 651	87 656	87 662	87 668	87 674
753	87 679	87 685	87 691	87 697	87 703	87 708	87 714	87 720	87 726	87 731
754	87 737	87 743	87 749	87 754	87 760	87 766	87 772	87 777	87 783	87 789
755	87 795	87 800	87 806	87 812	87 818	87 823	87 829	87 835	87 841	87 846
756	87 852	87 858	87 864	87 869	87 875	87 881	87 887	87 892	87 898	87 904
757	87 910	87 915	87 921	87 927	87 933	87 938	87 944	87 950	87 955	87 961
758	87 967	87 973	87 978	87 984	87 990	87 996	88 001	88 007	88 013	88 018
759	88 024	88 030	88 036	88 041	88 047	88 053	88 058	88 064	88 070	88 076
760	88 081	88 087	88 093	88 098	88 104	88 110	88 116	88 121	88 127	88 133
761	88 138	88 144	88 150	88 156	88 161	88 167	88 173	88 178	88 184	88 190
762	88 195	88 201	88 207	88 213	88 218	88 224	88 230	88 235	88 241	88 247
763	88 252	88 258	88 264	88 270	88 275	88 281	88 287	88 292	88 298	88 304
764	88 309	88 315	88 321	88 326	88 332	88 338	88 343	88 349	88 355	88 360
765	88 366	88 372	88 377	88 383	88 389	88 395	88 400	88 406	88 412	88 417
766	88 423	88 429	88 434	88 440	88 446	88 451	88 457	88 463	88 468	88 474
767	88 480	88 485	88 491	88 497	88 502	88 508	88 513	88 519	88 525	88 530
768	88 536	88 542	88 547	88 553	88 559	88 564	88 570	88 576	88 581	88 587
769	88 593	88 598	88 604	88 610	88 615	88 621	88 627	88 632	88 638	88 643
770	88 649	88 655	88 660	88 666	88 672	88 677	88 683	88 689	88 694	88 700
771	88 705	88 711	88 717	88 722	88 728	88 734	88 739	88 745	88 750	88 756
772	88 762	88 767	88 773	88 779	88 784	88 790	88 795	88 801	88 807	88 812
773	88 818	88 824	88 829	88 835	88 840	88 846	88 852	88 857	88 863	88 868
774	88 874	88 880	88 885	88 891	88 897	88 902	88 908	88 913	88 919	88 925
775	88 930	88 936	88 941	88 947	88 953	88 958	88 964	88 969	88 975	88 981
776	88 986	88 992	88 997	89 003	89 009	89 014	89 020	89 025	89 031	89 037
777	89 042	89 048	89 053	89 059	89 064	89 070	89 076	89 081	89 087	89 092
778	89 098	89 104	89 109	89 115	89 120	89 126	89 131	89 137	89 143	89 148
779	89 154	89 159	89 165	89 170	89 176	89 182	89 187	89 193	89 198	89 204
780	89 209	89 215	89 221	89 226	89 232	89 237	89 243	89 248	89 254	89 260
781	89 265	89 271	89 276	89 282	89 287	89 293	89 298	89 304	89 310	89 315
782	89 321	89 326	89 332	89 337	89 343	89 348	89 354	89 360	89 365	89 371
783	89 376	89 382	89 387	89 393	89 398	89 404	89 409	89 415	89 421	89 426
784	89 432	89 437	89 443	89 448	89 454	89 459	89 465	89 470	89 476	89 481
785	89 487	89 492	89 498	89 504	89 509	89 515	89 520	89 526	89 531	89 537
786	89 542	89 548	89 553	89 559	89 564	89 570	89 575	89 581	89 586	89 592
787	89 597	89 603	89 609	89 614	89 620	89 625	89 631	89 636	89 642	89 647
788	89 653	89 658	89 664	89 669	89 675	89 680	89 686	89 691	89 697	89 702
789	89 708	89 713	89 719	89 724	89 730	89 735	89 741	89 746	89 752	89 757
790	89 763	89 768	89 774	89 779	89 785	89 790	89 796	89 801	89 807	89 812
791	89 818	89 823	89 829	89 834	89 840	89 845	89 851	89 856	89 862	89 867
792	89 873	89 878	89 883	89 889	89 894	89 900	89 905	89 911	89 916	89 922
793	89 927	89 933	89 938	89 944	89 949	89 955	89 960	89 966	89 971	89 977
794	89 982	89 988	89 993	89 998	90 004	90 009	90 015	90 020	90 026	90 031
795	90 037	90 042	90 048	90 053	90 059	90 064	90 069	90 075	90 080	90 086
796	90 091	90 097	90 102	90 108	90 113	90 119	90 124	90 129	90 135	90 140
797	90 146	90 151	90 157	90 162	90 168	90 173	90 179	90 184	90 189	90 195
798	90 200	90 206	90 211	90 217	90 222	90 227	90 233	90 238	90 244	90 249
799	90 255	90 260	90 266	90 271	90 276	90 282	90 287	90 293	90 298	90 304
800	90 309	90 314	90 320	90 325	90 331	90 336	90 342	90 347	90 352	90 358
N	0	1	2	3	4	5	6	7	8	9

800—850

N	0	1	2	3	4	5	6	7	8	9
800	90 309	90 314	90 320	90 325	90 331	90 336	90 342	90 347	90 352	90 358
801	90 363	90 369	90 374	90 380	90 385	90 390	90 396	90 401	90 407	90 412
802	90 417	90 423	90 428	90 434	90 439	90 445	90 450	90 455	90 461	90 466
803	90 472	90 477	90 482	90 488	90 493	90 499	90 504	90 509	90 515	90 520
804	90 526	90 531	90 536	80 542	90 547	90 553	90 558	90 563	90 569	90 574
805	90 580	90 585	90 590	90 596	90 601	90 607	90 612	90 617	90 623	90 628
806	90 634	90 639	90 644	90 650	90 655	90 660	90 666	90 671	90 677	90 682
807	90 687	90 693	90 698	90 703	90 709	90 714	90 720	90 725	90 730	90 736
808	90 741	90 747	90 752	90 757	90 763	90 768	90 773	90 779	90 784	90 789
809	90 795	90 800	90 806	90 811	90 816	90 822	90 827	90 832	90 838	90 843
810	90 849	90 854	90 859	90 865	90 870	90 875	90 881	90 886	90 891	90 897
811	90 902	90 907	90 913	90 918	90 924	90 929	90 934	90 940	90 945	90 950
812	90 956	90 961	90 966	90 972	90 977	90 982	90 988	90 993	90 998	91 004
813	91 009	91 014	91 020	91 025	91 030	91 036	91 041	91 046	91 052	91 057
814	91 062	91 068	91 073	91 078	91 084	91 089	91 094	91 100	91 105	91 110
815	91 116	91 121	91 126	91 132	91 137	91 142	91 148	91 153	91 158	91 164
816	91 169	91 174	91 180	91 185	91 190	91 196	91 201	91 206	91 212	91 217
817	91 222	91 228	91 233	91 238	91 243	91 249	91 254	91 259	91 265	91 270
818	91 275	91 281	91 286	91 291	91 297	91 302	91 307	91 312	91 318	91 323
819	91 328	91 334	91 339	91 344	91 350	91 355	91 360	91 365	91 371	91 376
820	91 381	91 387	91 392	91 397	91 403	91 408	91 413	91 418	91 424	91 429
821	91 434	91 440	91 445	91 450	91 455	91 461	91 466	91 471	91 477	91 482
822	91 487	91 492	91 498	91 503	91 508	91 514	91 519	91 524	91 529	91 535
823	91 540	91 545	91 551	91 556	91 561	91 566	91 572	91 577	91 582	91 587
824	91 593	91 598	91 603	91 609	91 614	91 619	91 624	91 630	91 635	91 640
825	91 645	91 651	91 656	91 661	91 666	91 672	91 677	91 682	91 687	91 693
826	91 698	91 703	91 709	91 714	91 719	91 724	91 730	91 735	91 740	91 745
827	91 751	91 756	91 761	91 766	91 772	91 777	91 782	91 787	91 793	91 798
828	91 803	91 808	91 814	91 819	91 824	91 829	91 834	91 840	91 845	91 850
829	91 855	91 861	91 866	91 871	91 876	91 882	91 887	91 892	91 897	91 903
830	91 908	91 913	91 918	91 924	91 929	91 934	91 939	91 944	91 950	91 955
831	91 960	91 965	91 971	91 976	91 981	91 986	91 991	91 997	92 002	92 007
832	92 012	92 018	92 023	92 028	92 033	92 038	92 044	92 049	92 054	92 059
833	92 065	92 070	92 075	92 080	92 085	92 091	92 096	92 101	92 106	92 111
834	92 117	92 122	92 127	92 132	92 137	92 143	92 148	92 153	92 158	92 163
835	92 169	92 174	92 179	92 184	92 189	92 195	92 200	92 205	92 210	92 215
836	92 221	92 226	92 231	92 236	92 241	92 247	92 252	92 257	92 262	92 267
837	92 273	92 278	92 283	92 288	92 293	92 298	92 304	92 309	92 314	92 319
838	92 324	92 330	92 335	92 340	92 345	92 350	92 355	92 361	92 366	92 371
839	92 376	92 381	92 387	92 392	92 397	92 402	92 407	92 412	92 418	92 423
840	92 428	92 433	92 438	92 443	92 449	92 454	92 459	92 464	92 469	92 474
841	92 480	92 485	92 490	92 495	92 500	92 505	92 511	92 516	92 521	92 526
842	92 531	92 536	92 542	92 547	92 552	92 557	92 562	92 567	92 572	92 578
843	92 583	92 588	92 593	92 598	92 603	92 609	92 614	92 619	92 624	92 629
844	92 634	92 639	92 645	92 650	92 655	92 660	92 665	92 670	92 675	92 681
845	92 686	92 691	92 696	92 701	92 706	92 711	92 716	92 722	92 727	92 732
846	92 737	92 742	92 747	92 752	92 758	92 763	92 768	92 773	92 778	92 783
847	92 788	92 793	92 799	92 804	92 809	92 814	92 819	92 824	92 829	92 834
848	92 840	92 845	92 850	92 855	92 860	92 865	92 870	92 875	92 881	92 886
849	92 891	92 896	92 901	92 906	92 911	92 916	92 921	92 927	92 932	92 937
850	92 942	92 947	92 952	92 957	92 962	92 967	92 973	92 978	92 983	92 988

N 0 1 2 3 4 5 6 7 8 9

N	0	1	2	3	4	5	6	7	8	9
850	92 942	92 947	92 952	92 957	92 962	92 967	92 973	92 978	92 983	92 988
851	92 993	92 998	93 003	93 008	93 013	93 018	93 024	93 029	93 034	93 039
852	93 044	93 049	93 054	93 059	93 064	93 069	93 075	93 080	93 085	93 090
853	93 095	93 100	93 105	93 110	93 115	93 120	93 125	93 131	93 136	93 141
854	93 146	93 151	93 156	93 161	93 166	93 171	93 176	93 181	93 186	93 192
855	93 197	93 202	93 207	93 212	93 217	93 222	93 227	93 232	93 237	93 242
856	93 247	93 252	93 258	93 263	93 268	93 273	93 278	93 283	93 288	93 293
857	93 298	93 303	93 308	93 313	93 318	93 323	93 328	93 334	93 339	93 344
858	93 349	93 354	93 359	93 364	93 369	93 374	93 379	93 384	93 389	93 394
859	93 399	93 404	93 409	93 414	93 420	93 425	93 430	93 435	93 440	93 445
860	93 450	93 455	93 460	93 465	93 470	93 475	93 480	93 485	93 490	93 495
861	93 500	93 505	93 510	93 515	93 520	93 526	93 531	93 536	93 541	93 546
862	93 551	93 556	93 561	93 566	93 571	93 576	93 581	93 586	93 591	93 596
863	93 601	93 606	93 611	93 616	93 621	93 626	93 631	93 636	93 641	93 646
864	93 651	93 656	93 661	93 666	93 671	93 676	93 682	93 687	93 692	93 697
865	93 702	93 707	93 712	93 717	93 722	93 727	93 732	93 737	93 742	93 747
866	93 752	93 757	93 762	93 767	93 772	93 777	93 782	93 787	93 792	93 797
867	93 802	93 807	93 812	93 817	93 822	93 827	93 832	93 837	93 842	93 847
868	93 852	93 857	93 862	93 867	93 872	93 877	93 882	93 887	93 892	93 897
869	93 902	93 907	93 912	93 917	93 922	93 927	93 932	93 937	93 942	93 947
870	93 952	93 957	93 962	93 967	93 972	93 977	93 982	93 987	93 992	93 997
871	94 002	94 007	94 012	94 017	94 022	94 027	94 032	94 037	94 042	94 047
872	94 052	94 057	94 062	94 067	94 072	94 077	94 082	94 086	94 091	94 096
873	94 101	94 106	94 111	94 116	94 121	94 126	94 131	94 136	94 141	94 146
874	94 151	94 156	94 161	94 166	94 171	94 176	94 181	94 186	94 191	94 196
875	94 201	94 206	94 211	94 216	94 221	94 226	94 231	94 236	94 240	94 245
876	94 250	94 255	94 260	94 265	94 270	94 275	94 280	94 285	94 290	94 295
877	94 300	94 305	94 310	94 315	94 320	94 325	94 330	94 335	94 340	94 345
878	94 349	94 354	94 359	94 364	94 369	94 374	94 379	94 384	94 389	94 394
879	94 399	94 404	94 409	94 414	94 419	94 424	94 429	94 433	94 438	94 443
880	94 448	94 453	94 458	94 463	94 468	94 473	94 478	94 483	94 488	94 493
881	94 498	94 503	94 507	94 512	94 517	94 522	94 527	94 532	94 537	94 542
882	94 547	94 552	94 557	94 562	94 567	94 571	94 576	94 581	94 586	94 591
883	94 596	94 601	94 606	94 611	94 616	94 621	94 626	94 630	94 635	94 640
884	94 645	94 650	94 655	94 660	94 665	94 670	94 675	94 680	94 685	94 689
885	94 694	94 699	94 704	94 709	94 714	94 719	94 724	94 729	94 734	94 738
886	94 743	94 748	94 753	94 758	94 763	94 768	94 773	94 778	94 783	94 787
887	94 792	94 797	94 802	94 807	94 812	94 817	94 822	94 827	94 832	94 836
888	94 841	94 846	94 851	94 856	94 861	94 866	94 871	94 876	94 880	94 885
889	94 890	94 895	94 900	94 905	94 910	94 915	94 919	94 924	94 929	94 934
890	94 939	94 944	94 949	94 954	94 959	94 963	94 968	94 973	94 978	94 983
891	94 988	94 993	94 998	95 002	95 007	95 012	95 017	95 022	95 027	95 032
892	95 036	95 041	95 046	95 051	95 056	95 061	95 066	95 071	95 075	95 080
893	95 085	95 090	95 095	95 100	95 105	95 109	95 114	95 119	95 124	95 129
894	95 134	95 139	95 143	95 148	95 153	95 158	95 163	95 168	95 173	95 177
895	95 182	95 187	95 192	95 197	95 202	95 207	95 211	95 216	95 221	95 226
896	95 231	95 236	95 240	95 245	95 250	95 255	95 260	95 265	95 270	95 274
897	95 279	95 284	95 289	95 294	95 299	95 303	95 308	95 313	95 318	95 323
898	95 328	95 332	95 337	95 342	95 347	95 352	95 357	95 361	95 366	95 371
899	95 376	95 381	95 386	95 390	95 395	95 400	95 405	95 410	95 415	95 419
900	95 424	95 429	95 434	95 439	95 444	95 448	95 453	95 458	95 463	95 468
N	0	1	2	3	4	5	6	7	8	9

900—950

N	0	1	2	3	4	5	6	7	8	9
900	95 424	95 429	95 434	95 439	95 444	95 448	95 453	95 458	95 463	95 468
901	95 472	95 477	95 482	95 487	95 492	95 497	95 501	95 506	95 511	95 516
902	95 521	95 525	95 530	95 535	95 540	95 545	95 550	95 554	95 559	95 564
903	95 569	95 574	95 578	95 583	95 588	95 593	95 598	95 602	95 607	95 612
904	95 617	95 622	95 626	95 631	95 636	95 641	95 646	95 650	95 655	95 660
905	95 665	95 670	95 674	95 679	95 684	95 689	95 694	95 698	95 703	95 708
906	95 713	95 718	95 722	95 727	95 732	95 737	95 742	95 746	95 751	95 756
907	95 761	95 766	95 770	95 775	95 780	95 785	95 789	95 794	95 799	95 804
908	95 809	95 813	95 818	95 823	95 828	95 832	95 837	95 842	95 847	95 852
909	95 856	95 861	95 866	95 871	95 875	95 880	95 885	95 890	95 895	95 899
910	95 904	95 909	95 914	95 918	95 923	95 928	95 933	95 938	95 942	95 947
911	95 952	95 957	95 961	95 966	95 971	95 976	95 980	95 985	95 990	95 995
912	95 999	96 004	96 009	96 014	96 019	96 023	96 028	96 033	96 038	96 042
913	96 047	96 052	96 057	96 061	96 066	96 071	96 076	96 080	96 085	96 090
914	96 095	96 099	96 104	96 109	96 114	96 118	96 123	96 128	96 133	96 137
915	96 142	96 147	96 152	96 156	96 161	96 166	96 171	96 175	96 180	96 185
916	96 190	96 194	96 199	96 204	96 209	96 213	96 218	96 223	96 227	96 232
917	96 237	96 242	96 246	96 251	96 256	96 261	96 265	96 270	96 275	96 280
918	96 284	96 289	96 294	96 298	96 303	96 308	96 313	96 317	96 322	96 327
919	96 332	96 336	96 341	96 346	96 350	96 355	96 360	96 365	96 369	96 374
920	96 379	96 384	96 388	96 393	96 398	96 402	96 407	96 412	96 417	96 421
921	96 426	96 431	96 435	96 440	96 445	96 450	96 454	96 459	96 464	96 468
922	96 473	96 478	96 483	96 487	96 492	96 497	96 501	96 506	96 511	96 515
923	96 520	96 525	96 530	96 534	96 539	96 544	96 548	96 553	96 558	96 562
924	96 567	96 572	96 577	96 581	96 586	96 591	96 595	96 600	96 605	96 609
925	96 614	96 619	96 624	96 628	96 633	96 638	96 642	96 647	96 652	96 656
926	96 661	96 666	96 670	96 675	96 680	96 685	96 689	96 694	96 699	96 703
927	96 708	96 713	96 717	96 722	96 727	96 731	96 736	96 741	96 745	96 750
928	96 755	96 759	96 764	96 769	96 774	96 778	96 783	96 788	96 792	96 797
929	96 802	96 806	96 811	96 816	96 820	96 825	96 830	96 834	96 839	96 844
930	96 848	96 853	96 858	96 862	96 867	96 872	96 876	96 881	96 886	96 890
931	96 895	96 900	96 904	96 909	96 914	96 918	96 923	96 928	96 932	96 937
932	96 942	96 946	96 951	96 956	96 960	96 965	96 970	96 974	96 979	96 984
933	96 988	96 993	96 997	97 002	97 007	97 011	97 016	97 021	97 025	97 030
934	97 035	97 039	97 044	97 049	97 053	97 058	97 063	97 067	97 072	97 077
935	97 081	97 086	97 090	97 095	97 100	97 104	97 109	97 114	97 118	97 123
936	97 128	97 132	97 137	97 142	97 146	97 151	97 155	97 160	97 165	97 169
937	97 174	97 179	97 183	97 188	97 192	97 197	97 202	97 206	97 211	97 216
938	97 220	97 225	97 230	97 234	97 239	97 243	97 248	97 253	97 257	97 262
939	97 267	97 271	97 276	97 280	97 285	97 290	97 294	97 299	97 304	97 308
940	97 313	97 317	97 322	97 327	97 331	97 336	97 340	97 345	97 350	97 354
941	97 359	97 364	97 368	97 373	97 377	97 382	97 387	97 391	97 396	97 400
942	97 405	97 410	97 414	97 419	97 424	97 428	97 433	97 437	97 442	97 447
943	97 451	97 456	97 460	97 465	97 470	97 474	97 479	97 483	97 488	97 493
944	97 497	97 502	97 506	97 511	97 516	97 520	97 525	97 529	97 534	97 539
945	97 543	97 548	97 552	97 557	97 562	97 566	97 571	97 575	97 580	97 585
946	97 589	97 594	97 598	97 603	97 607	97 612	97 617	97 621	97 626	97 630
947	97 635	97 640	97 644	97 649	97 653	97 658	97 663	97 667	97 672	97 676
948	97 681	97 685	97 690	97 695	97 699	97 704	97 708	97 713	97 717	97 722
949	97 727	97 731	97 736	97 740	97 745	97 749	97 754	97 759	97 763	97 768
950	97 772	97 777	97 782	97 786	97 791	97 795	97 800	97 804	97 809	97 813
N	0	1	2	3	4	5	6	7	8	9

900—950

N	0	1	2	3	4	5	6	7	8	9
950	97 772	97 777	97 782	97 786	97 791	97 795	97 800	97 804	97 809	97 813
951	97 818	97 823	97 827	97 832	97 836	97 841	97 845	97 850	97 855	97 859
952	97 864	97 868	97 873	97 877	97 882	97 886	97 891	97 896	97 900	97 905
953	97 909	97 914	97 918	97 923	97 928	97 932	97 937	97 941	97 946	97 950
954	97 955	97 959	97 964	97 968	97 973	97 978	97 982	97 987	97 991	97 996
955	98 000	98 005	98 009	98 014	98 019	98 023	98 028	98 032	98 037	98 041
956	98 046	98 050	98 055	98 059	98 064	98 068	98 073	98 078	98 082	98 087
957	98 091	98 096	98 100	98 105	98 109	98 114	98 118	98 123	98 127	98 132
958	98 137	98 141	98 146	98 150	98 155	98 159	98 164	98 168	98 173	98 177
959	98 182	98 186	98 191	98 195	98 200	98 204	98 209	98 214	98 218	98 223
960	98 227	98 232	98 236	98 241	98 245	98 250	98 254	98 259	98 263	98 268
961	98 272	98 277	98 281	98 286	98 290	98 295	98 299	98 304	98 308	98 313
962	98 318	98 322	98 327	98 331	98 336	98 340	98 345	98 349	98 354	98 358
963	98 363	98 367	98 372	98 376	98 381	98 385	98 390	98 394	98 399	98 403
964	98 408	98 412	98 417	98 421	98 426	98 430	98 435	98 439	98 444	98 448
965	98 453	98 457	98 462	98 466	98 471	98 475	98 480	98 484	98 489	98 493
966	98 498	98 502	98 507	98 511	98 516	98 520	98 525	98 529	98 534	98 538
967	98 543	98 547	98 552	98 556	98 561	98 565	98 570	98 574	98 579	98 583
968	98 588	98 592	98 597	98 601	98 605	98 610	98 614	98 619	98 623	98 628
969	98 632	98 637	98 641	98 646	98 650	98 655	98 659	98 664	98 668	98 673
970	98 677	98 682	98 686	98 691	98 695	98 700	98 704	98 709	98 713	98 717
971	98 722	98 726	98 731	98 735	98 740	98 744	98 749	98 753	98 758	98 762
972	98 767	98 771	98 776	98 780	98 784	98 789	98 793	98 798	98 802	98 807
973	98 811	98 816	98 820	98 825	98 829	98 834	98 838	98 843	98 847	98 851
974	98 856	98 860	98 865	98 869	98 874	98 878	98 883	98 887	98 892	98 896
975	98 900	98 905	98 909	98 914	98 918	98 923	98 927	98 932	98 936	98 941
976	98 945	98 949	98 954	98 958	98 963	98 967	98 972	98 976	98 981	98 985
977	98 989	98 994	98 998	99 003	99 007	99 012	99 016	99 021	99 025	99 029
978	99 034	99 038	99 043	99 047	99 052	99 056	99 061	99 065	99 069	99 074
979	99 078	99 083	99 087	99 092	99 096	99 100	99 105	99 109	99 114	99 118
980	99 123	99 127	99 131	99 136	99 140	99 145	99 149	99 154	99 158	99 162
981	99 167	99 171	99 176	99 180	99 185	99 189	99 193	99 198	99 202	99 207
982	99 211	99 216	99 220	99 224	99 229	99 233	99 238	99 242	99 247	99 251
983	99 255	99 260	99 264	99 269	99 273	99 277	99 282	99 286	99 291	99 295
984	99 300	99 304	99 308	99 313	99 317	99 322	99 326	99 330	99 335	99 339
985	99 344	99 348	99 352	99 357	99 361	99 366	99 370	99 374	99 379	99 383
986	99 388	99 392	99 396	99 401	99 405	99 410	99 414	99 419	99 423	99 427
987	99 432	99 436	99 441	99 445	99 449	99 454	99 458	99 463	99 467	99 471
988	99 476	99 480	99 484	99 489	99 493	99 498	99 502	99 506	99 511	99 515
989	99 520	99 524	99 528	99 533	99 537	99 542	99 546	99 550	99 555	99 559
990	99 564	99 568	99 572	99 577	99 581	99 585	99 590	99 594	99 599	99 603
991	99 607	99 612	99 616	99 621	99 625	99 629	99 634	99 638	99 642	99 647
992	99 651	99 656	99 660	99 664	99 669	99 673	99 677	99 682	99 686	99 691
993	99 695	99 699	99 704	99 708	99 712	99 717	99 721	99 726	99 730	99 734
994	99 739	99 743	99 747	99 752	99 756	99 760	99 765	99 769	99 774	99 778
995	99 782	99 787	99 791	99 795	99 800	99 804	99 808	99 813	99 817	99 822
996	99 826	99 830	99 835	99 839	99 843	99 848	99 852	99 856	99 861	99 865
997	99 870	99 874	99 878	99 883	99 887	99 891	99 896	99 900	99 904	99 909
998	99 913	99 917	99 922	99 926	99 930	99 935	99 939	99 944	99 948	99 952
999	99 957	99 961	99 965	99 970	99 974	99 978	99 983	99 987	99 991	99 996
1000	00 000	00 004	00 009	00 013	00 017	00 022	00 026	00 030	00 035	00 039
N	0	1	2	3	4	5	6	7	8	9

TABLE II.—LOGARITHMS OF CONSTANTS.

	log
Circumference of the Circle in degrees . . . . . = 360	2. 55 630 250
Circumference of the Circle in minutes . . . . . = 21 600	4. 33 445 375
Circumference of the Circle in seconds . . . . . = 1 296 000	6. 11 260 500
If the radius $r = 1$, half the Circumference of the Circle is $\pi = 3.14\,159\,265\,358\,979\,323\,846\,264\,338\,328$	0. 49 714 987

Also:	log		log
$2\pi = 6.28\,318\,531$	0. 79 817 987	$\pi^2 = 9.86\,960\,440$	0. 99 429 975
$4\pi = 12.56\,637\,061$	1. 09 920 986	$\frac{1}{\pi^2} = 0.10\,132\,118$	9. 00 570 025 − 10
$\frac{\pi}{2} = 1.57\,079\,633$	0. 19 611 988	$\sqrt{\pi} = 1.77\,245\,385$	0. 24 857 494
$\frac{\pi}{3} = 1.04\,719\,755$	0. 02 002 862	$\frac{1}{\sqrt{\pi}} = 0.56\,418\,958$	9. 75 142 506 − 10
$\frac{4\pi}{3} = 4.18\,879\,020$	0. 62 208 861	$\sqrt{\frac{3}{\pi}} = 0.97\,720\,502$	9. 98 998 569 − 10
$\frac{\pi}{4} = 0.78\,539\,816$	9. 89 508 988 − 10	$\sqrt{\frac{4}{\pi}} = 1.12\,837\,917$	0. 05 245 506
$\frac{\pi}{6} = 0.52\,359\,878$	9. 71 899 862 − 10	$\sqrt[3]{\pi} = 1.46\,459\,189$	0. 16 571 662
$\frac{1}{\pi} = 0.31\,830\,989$	9. 50 285 013 − 10	$\frac{1}{\sqrt[3]{\pi}} = 0.68\,278\,406$	9. 83 428 338 − 10
$\frac{1}{2\pi} = 0.15\,915\,494$	9. 20 182 013 − 10	$\sqrt[3]{\pi^2} = 2.14\,502\,940$	0. 33 143 325
$\frac{3}{\pi} = 0.95\,492\,966$	9. 97 997 138 − 10	$\sqrt[3]{\frac{3}{4\pi}} = 0.62\,035\,049$	9. 79 263 713 − 10
$\frac{4}{\pi} = 1.27\,323\,954$	0. 10 491 012	$\sqrt[3]{\frac{\pi}{6}} = 0.80\,599\,598$	9. 90 633 287 − 10
$\frac{3}{4\pi} = 0.23\,873\,241$	9. 37 791 139 − 10		

	log
Arc a, whose length is equal to the radius r, is:	
in degrees . . . . . a° . . . . . $= \frac{180}{\pi}$ . . . . . $= 57.29\,577\,951^\circ$ . .	1. 75 812 263
in minutes . . . . . a' . . . . . $= \frac{10\,800}{\pi}$ . . . . . $= 3\,437.74\,677'$ . .	3. 53 627 388
in seconds . . . . . a'' . . . . . $= \frac{648\,000}{\pi}$ . . . . . $= 206\,264.806''$ . .	5. 31 442 513
Arc $2a$, whose length is equal to twice the radius, $2r$, is:	
in degrees . . . . . $2a^\circ$ . . . . $= \frac{360}{\pi}$ . . . . . $= 114.59\,155\,903^\circ$	2. 05 915 263
in minutes . . . . . $2a'$ . . . . $= \frac{21\,600}{\pi}$ . . . . . $= 6\,875.49\,354'$ . .	3. 83 730 388
in seconds . . . . . $2a''$ . . . . $= \frac{1\,296\,000}{\pi}$ . . . . $= 412\,529.612''$ . .	5. 61 545 513
If the radius $r = 1$, the length of the arc is:	
for 1 degree . . . . $\frac{1}{a^\circ}$ . . . . $= \frac{\pi}{180}$ . . . . . $= 0.01\,745\,329\ldots$	8. 24 187 737 − 10
for 1 minute . . . . $\frac{1}{a'}$ . . . . $= \frac{\pi}{10\,800}$ . . . . . $= 0.00\,029\,089\ldots$	6. 46 372 612 − 10
for 1 second . . . . $\frac{1}{a''}$ . . . . $= \frac{\pi}{648\,000}$ . . . . . $= 0.00\,000\,485\ldots$	4. 68 557 487 − 10
for ½ degree . . . . $\frac{1}{2a^\circ}$ . . . . $= \frac{\pi}{360}$ . . . . . $= 0.00\,872\,665\ldots$	7. 94 084 737 − 10
for ½ minute . . . . $\frac{1}{2a'}$ . . . . $= \frac{\pi}{21\,600}$ . . . . . $= 0.00\,014\,544\ldots$	6. 16 269 612 − 10
for ½ second . . . . $\frac{1}{2a''}$ . . . . $= \frac{\pi}{1\,296\,000}$ . . . . $= 0.00\,000\,242\ldots$	4. 38 454 487 − 10
Sin $1''$ in the unit circle . . . . . $= 0.00\,000\,485\ldots$	4. 68 557 487 − 10

TABLE III.

THE LOGARITHMS

OF THE

TRIGONOMETRIC FUNCTIONS:

From 0° to 0° 3′, or 89° 57′ to 90°, for every second;
From 0° to 2°, or 88° to 90°, for every ten seconds;
From 1° to 89°, for every minute.

NOTE. To all the logarithms −10 is to be appended.

log sin **0°** log tan = log sin, log cos = 10.00 000

″	0′	1′	2′	″	″	0′	1′	2′	″
0	—	6.46 373	6.76 476	60	30	6.16 270	6.63 982	6.86 167	30
1	4.68 557	6.47 090	6.76 836	59	31	6.17 694	6.64 462	6.86 455	29
2	4.98 660	6.47 797	6.77 193	58	32	6.19 072	6.64 936	6.86 742	28
3	5.16 270	6.48 492	6.77 548	57	33	6.20 409	6.65 406	6.87 027	27
4	5.28 763	6.49 175	6.77 900	56	34	6.21 705	6.65 870	6.87 310	26
5	5.38 454	6.49 849	6.78 248	55	35	6.22 964	6.66 330	6.87 591	25
6	5.46 373	6.50 512	6.78 595	54	36	6.24 188	6.66 785	6.87 870	24
7	5.53 067	6.51 165	6.78 938	53	37	6.25 378	6.67 235	6.88 147	23
8	5.58 866	6.51 808	6.79 278	52	38	6.26 536	6.67 680	6.88 423	22
9	5.63 982	6.52 442	6.79 616	51	39	6.27 664	6.68 121	6.88 697	21
10	5.68 557	6.53 067	6.79 952	50	40	6.28 763	6.68 557	6.88 969	20
11	5.72 697	6.53 683	6.80 285	49	41	6.29 836	6.68 990	6.89 240	19
12	5.76 476	6.54 291	6.80 615	48	42	6.30 882	6.69 418	6.89 509	18
13	5.79 952	6.54 890	6.80 943	47	43	6.31 904	6.69 841	6.89 776	17
14	5.83 170	6.55 481	6.81 268	46	44	6.32 903	6.70 261	6.90 042	16
15	5.86 167	6.56 064	6.81 591	45	45	6.33 879	6.70 676	6.90 306	15
16	5.88 969	6.56 639	6.81 911	44	46	6.34 833	6.71 088	6.90 568	14
17	5.91 602	6.57 207	6.82 230	43	47	6.35 767	6.71 496	6.90 829	13
18	5.94 085	6.57 767	6.82 545	42	48	6.36 682	6.71 900	6.91 088	12
19	5.96 433	6.58 320	6.82 859	41	49	6.37 577	6.72 300	6.91 346	11
20	5.98 660	6.58 866	6.83 170	40	50	6.38 454	6.72 697	6.91 602	10
21	6.00 779	6.59 406	6.83 479	39	51	6.39 315	6.73 090	6.91 857	9
22	6.02 800	6.59 939	6.83 786	38	52	6.40 158	6.73 479	6.92 110	8
23	6.04 730	6.60 465	6.84 091	37	53	6.40 985	6.73 865	6.92 362	7
24	6.06 579	6.60 985	6.84 394	36	54	6.41 797	6.74 248	6.92 612	6
25	6.08 351	6.61 499	6.84 694	35	55	6.42 594	6.74 627	6.92 861	5
26	6.10 055	6.62 007	6.84 993	34	56	6.43 376	6.75 003	6.93 109	4
27	6.11 694	6.62 509	6.85 289	33	57	6.44 145	6.75 376	6.93 355	3
28	6.13 273	6.63 006	6.85 584	32	58	6.44 900	6.75 746	6.93 599	2
29	6.14 797	6.63 496	6.85 876	31	59	6.45 643	6.76 112	6.93 843	1
30	6.16 270	6.63 982	6.86 167	30	60	6.46 373	6.76 476	6.94 085	0
″	59′	58′	57′	″	″	59′	58′	57′	″

log cot = log cos, log sin = 10.00 000 **89°** log cos

0°

′ ″	log sin	log tan	log cos	″ ′	′ ″	log sin	log tan	log cos	″ ′
0 0	—	—	10.00000	0 60	10 0	7. 46 373	7. 46 373	10.00000	0 50
10	5. 68 557	5. 68 557	10.00000	50	10	7. 47 090	7. 47 091	10.00000	50
20	5. 98 660	5. 98 660	10.00000	40	20	7. 47 797	7. 47 797	10.00000	40
30	6. 16 270	6. 16 270	10.00000	30	30	7. 48 491	7. 48 492	10.00000	30
40	6. 28 763	6. 28 763	10.00000	20	40	7. 49 175	7. 49 176	10.00000	20
50	6. 38 454	6. 38 454	10.00000	10	50	7. 49 849	7. 49 849	10.00000	10
1 0	6. 46 373	6. 46 373	10.00000	0 59	11 0	7. 50 512	7. 50 512	10.00000	0 49
10	6. 53 067	6. 53 067	10.00000	50	10	7. 51 165	7. 51 165	10.00000	50
20	6. 58 866	6. 58 866	10.00000	40	20	7. 51 808	7. 51 809	10.00000	40
30	6. 63 982	6. 63 982	10.00000	30	30	7. 52 442	7. 52 443	10.00000	30
40	6. 68 557	6. 68 557	10.00000	20	40	7. 53 067	7. 53 067	10.00000	20
50	6. 72 697	6. 72 697	10.00000	10	50	7. 53 683	7. 53 683	10.00000	10
2 0	6. 76 476	6. 76 476	10.00000	0 58	12 0	7. 54 291	7. 54 291	10.00000	0 48
10	6. 79 952	6. 79 952	10.00000	50	10	7. 54 890	7. 54 890	10.00000	50
20	6. 83 170	6. 83 170	10.00000	40	20	7. 55 481	7. 55 481	10.00000	40
30	6. 86 167	6. 86 167	10.00000	30	30	7. 56 064	7. 56 064	10.00000	30
40	6. 88 969	6. 88 969	10.00000	20	40	7. 56 639	7. 56 639	10.00000	20
50	6. 91 602	6. 91 602	10.00000	10	50	7. 57 206	7. 57 207	10.00000	10
3 0	6. 94 085	6. 94 085	10.00000	0 57	13 0	7. 57 767	7. 57 767	10.00000	0 47
10	6. 96 433	6. 96 433	10.00000	50	10	7. 58 320	7. 58 320	10.00000	50
20	6. 98 660	6. 98 661	10.00000	40	20	7. 58 866	7. 58 867	10.00000	40
30	7. 00 779	7. 00 779	10.00000	30	30	7. 59 406	7. 59 406	10.00000	30
40	7. 02 800	7. 02 800	10.00000	20	40	7. 59 939	7. 59 939	10.00000	20
50	7. 04 730	7. 04 730	10.00000	10	50	7. 60 465	7. 60 466	10.00000	10
4 0	7. 06 579	7. 06 579	10.00000	0 56	14 0	7. 60 985	7. 60 986	10.00000	0 46
10	7. 08 351	7. 08 352	10.00000	50	10	7. 61 499	7. 61 500	10.00000	50
20	7. 10 055	7. 10 055	10.00000	40	20	7. 62 007	7. 62 008	10.00000	40
30	7. 11 694	7. 11 694	10.00000	30	30	7. 62 509	7. 62 510	10.00000	30
40	7. 13 273	7. 13 273	10.00000	20	40	7. 63 006	7. 63 006	10.00000	20
50	7. 14 797	7. 14 797	10.00000	10	50	7. 63 496	7. 63 497	10.00000	10
5 0	7. 16 270	7. 16 270	10.00000	0 55	15 0	7. 63 982	7. 63 982	10.00000	0 45
10	7. 17 694	7. 17 694	10.00000	50	10	7. 64 461	7. 64 462	10.00000	50
20	7. 19 072	7. 19 073	10.00000	40	20	7. 64 936	7. 64 937	10.00000	40
30	7. 20 409	7. 20 409	10.00000	30	30	7. 65 406	7. 65 406	10.00000	30
40	7. 21 705	7. 21 705	10.00000	20	40	7. 65 870	7. 65 871	10.00000	20
50	7. 22 964	7. 22 964	10.00000	10	50	7. 66 330	7. 66 330	10.00000	10
6 0	7. 24 188	7. 24 188	10.00000	0 54	16 0	7. 66 784	7. 66 785	10.00000	0 44
10	7. 25 378	7. 25 378	10.00000	50	10	7. 67 235	7. 67 235	10.00000	50
20	7. 26 536	7. 26 536	10.00000	40	20	7. 67 680	7. 67 680	10.00000	40
30	7. 27 664	7. 27 664	10.00000	30	30	7. 68 121	7. 68 121	10.00000	30
40	7. 28 763	7. 28 764	10.00000	20	40	7. 68 557	7. 68 558	9.99999	20
50	7. 29 836	7. 29 836	10.00000	10	50	7. 68 989	7. 68 990	9.99999	10
7 0	7. 30 882	7. 30 882	10.00000	0 53	17 0	7. 69 417	7. 69 418	9. 99 999	0 43
10	7. 31 904	7. 31 904	10.00000	50	10	7. 69 841	7. 69 842	9. 99 999	50
20	7. 32 903	7. 32 903	10.00000	40	20	7. 70 261	7. 70 261	9. 99 999	40
30	7. 33 879	7. 33 879	10.00000	30	30	7. 70 676	7. 70 677	9. 99 999	30
40	7. 34 833	7. 34 833	10.00000	20	40	7. 71 088	7. 71 088	9. 99 999	20
50	7. 35 767	7. 35 767	10.00000	10	50	7. 71 496	7. 71 496	9. 99 999	10
8 0	7. 36 682	7. 36 682	10.00000	0 52	18 0	7. 71 900	7. 71 900	9. 99 999	0 42
10	7. 37 577	7. 37 577	10.00000	50	10	7. 72 300	7. 72 301	9. 99 999	50
20	7. 38 454	7. 38 455	10.00000	40	20	7. 72 697	7. 72 697	9. 99 999	40
30	7. 39 314	7. 39 315	10.00000	30	30	7. 73 090	7. 73 090	9. 99 999	30
40	7. 40 158	7. 40 158	10.00000	20	40	7. 73 479	7. 73 480	9. 99 999	20
50	7. 40 985	7. 40 985	10.00000	10	50	7. 73 865	7. 73 866	9. 99 999	10
9 0	7. 41 797	7. 41 797	10.00000	0 51	19 0	7. 74 248	7. 74 248	9. 99 999	0 41
10	7. 42 594	7. 42 594	10.00000	50	10	7. 74 627	7. 74 628	9. 99 999	50
20	7. 43 376	7. 43 376	10.00000	40	20	7. 75 003	7. 75 004	9. 99 999	40
30	7. 44 145	7. 44 145	10.00000	30	30	7. 75 376	7. 75 377	9. 99 999	30
40	7. 44 900	7. 44 900	10.00000	20	40	7. 75 745	7. 75 746	9. 99 999	20
50	7. 45 643	7. 45 643	10.00000	10	50	7. 76 112	7. 76 113	9. 99 999	10
10 0	7. 46 373	7. 46 373	10.00000	0 50	20 0	7. 76 475	7. 76 476	9. 99 999	0 40
′ ″	log cos	log cot	log sin	″ ′	′ ″	log cos	log cot	log sin	″ ′

89°

′ ″	log sin	log tan	log cos	″ ′	′ ″	log sin	log tan	log cos	″ ′
20 0	7. 76 475	7. 76 476	9. 99 999	**0 40**	**30 0**	7. 94 084	7. 94 086	9. 99 998	**0 30**
10	7. 76 836	7. 76 837	9. 99 999	50	10	7. 94 325	7. 94 326	9. 99 998	50
20	7. 77 193	7. 77 194	9. 99 999	40	20	7. 94 564	7. 94 566	9. 99 998	40
30	7. 77 548	7. 77 549	9. 99 999	30	30	7. 94 802	7. 94 804	9. 99 998	30
40	7. 77 899	7. 77 900	9. 99 999	20	40	7. 95 039	7. 95 040	9. 99 998	20
50	7. 78 248	7. 78 249	9. 99 999	10	50	7. 95 274	7. 95 276	9. 99 998	10
21 0	7. 78 594	7. 78 595	9. 99 999	**0 39**	**31 0**	7. 95 508	7. 95 510	9. 99 998	**0 29**
10	7. 78 938	7. 78 938	9. 99 999	50	10	7. 95 741	7. 95 743	9. 99 998	50
20	7. 79 278	7. 79 279	9. 99 999	40	20	7. 95 973	7. 95 974	9. 99 998	40
30	7. 79 616	7. 79 617	9. 99 999	30	30	7. 96 203	7. 96 205	9. 99 998	30
40	7. 79 952	7. 79 952	9. 99 999	20	40	7. 96 432	7. 96 434	9. 99 998	20
50	7. 80 284	7. 80 285	9. 99 999	10	50	7. 96 660	7. 96 662	9. 99 998	10
22 0	7. 80 615	7. 80 615	9. 99 999	**0 38**	**32 0**	7. 96 887	7. 96 889	9. 99 998	**0 28**
10	7. 80 942	7. 80 943	9. 99 999	50	10	7. 97 113	7. 97 114	9. 99 998	50
20	7. 81 268	7. 81 269	9. 99 999	40	20	7. 97 337	7. 97 339	9. 99 998	40
30	7. 81 591	7. 81 591	9. 99 999	30	30	7. 97 560	7. 97 562	9. 99 998	30
40	7. 81 911	7. 81 912	9. 99 999	20	40	7. 97 782	7. 97 784	9. 99 998	20
50	7. 82 229	7. 82 230	9. 99 999	10	50	7. 98 003	7. 98 005	9. 99 998	10
23 0	7. 82 545	7. 82 546	9. 99 999	**0 37**	**33 0**	7. 98 223	7. 98 225	9. 99 998	**0 27**
10	7. 82 859	7. 82 860	9. 99 999	50	10	7. 98 442	7. 98 444	9. 99 998	50
20	7. 83 170	7. 83 171	9. 99 999	40	20	7. 98 660	7. 98 662	9. 99 998	40
30	7. 83 479	7. 83 480	9. 99 999	30	30	7. 98 876	7. 98 878	9. 99 998	30
40	7. 83 786	7. 83 787	9. 99 999	20	40	7. 99 092	7. 99 094	9. 99 998	20
50	7. 84 091	7. 84 092	9. 99 999	10	50	7. 99 306	7. 99 308	9. 99 998	10
24 0	7. 84 393	7. 84 394	9. 99 999	**0 36**	**34 0**	7. 99 520	7. 99 522	9. 99 998	**0 26**
10	7. 84 694	7. 84 695	9. 99 999	50	10	7. 99 732	7. 99 734	9. 99 998	50
20	7. 84 992	7. 84 994	9. 99 999	40	20	7. 99 943	7. 99 946	9. 99 998	40
30	7. 85 289	7. 85 290	9. 99 999	30	30	8. 00 154	8. 00 156	9. 99 998	30
40	7. 85 583	7. 85 584	9. 99 999	20	40	8. 00 363	8. 00 365	9. 99 998	20
50	7. 85 876	7. 85 877	9. 99 999	10	50	8. 00 571	8. 00 574	9. 99 998	10
25 0	7. 86 166	7. 86 167	9. 99 999	**0 35**	**35 0**	8. 00 779	8. 00 781	9. 99 998	**0 25**
10	7. 86 455	7. 86 456	9. 99 999	50	10	8. 00 985	8. 00 987	9. 99 998	50
20	7. 86 741	7. 86 743	9. 99 999	40	20	8. 01 190	8. 01 193	9. 99 998	40
30	7. 87 026	7. 87 027	9. 99 999	30	30	8. 01 395	8. 01 397	9. 99 998	30
40	7. 87 309	7. 87 310	9. 99 999	20	40	8. 01 598	8. 01 600	9. 99 998	20
50	7. 87 590	7. 87 591	9. 99 999	10	50	8. 01 801	8. 01 803	9. 99 998	10
26 0	7. 87 870	7. 87 871	9. 99 999	**0 34**	**36 0**	8. 02 002	8. 02 004	9. 99 998	**0 24**
10	7. 88 147	7. 88 148	9. 99 999	50	10	8. 02 203	8. 02 205	9. 99 998	50
20	7. 88 423	7. 88 424	9. 99 999	40	20	8. 02 402	8. 02 405	9. 99 998	40
30	7. 88 697	7. 88 698	9. 99 999	30	30	8. 02 601	8. 02 604	9. 99 998	30
40	7. 88 969	7. 88 970	9. 99 999	20	40	8. 02 799	8. 02 801	9. 99 998	20
50	7. 89 240	7. 89 241	9. 99 999	10	50	8. 02 996	8. 02 998	9. 99 998	10
27 0	7. 89 509	7. 89 510	9. 99 999	**0 33**	**37 0**	8. 03 192	8. 03 194	9. 99 997	**0 23**
10	7. 89 776	7. 89 777	9. 99 999	50	10	8. 03 387	8. 03 390	9. 99 997	50
20	7. 90 041	7. 90 043	9. 99 999	40	20	8. 03 581	8. 03 584	9. 99 997	40
30	7. 90 305	7. 90 307	9. 99 999	30	30	8. 03 775	8. 03 777	9. 99 997	30
40	7. 90 568	7. 90 569	9. 99 999	20	40	8. 03 967	8. 03 970	9. 99 997	20
50	7. 90 829	7. 90 830	9. 99 999	10	50	8. 04 159	8. 04 162	9. 99 997	10
28 0	7. 91 088	7. 91 089	9. 99 999	**0 32**	**38 0**	8. 04 350	8. 04 353	9. 99 997	**0 22**
10	7. 91 346	7. 91 347	9. 99 999	50	10	8. 04 540	8. 04 543	9. 99 997	50
20	7. 91 602	7. 91 603	9. 99 999	40	20	8. 04 729	8. 04 732	9. 99 997	40
30	7. 91 857	7. 91 858	9. 99 999	30	30	8. 04 918	8. 04 921	9. 99 997	30
40	7. 92 110	7. 92 111	9. 99 998	20	40	8. 05 105	8. 05 108	9. 99 997	20
50	7. 92 362	7. 92 363	9. 99 998	10	50	8. 05 292	8. 05 295	9. 99 997	10
29 0	7. 92 612	7. 92 613	9. 99 998	**0 31**	**39 0**	8. 05 478	8. 05 481	9. 99 997	**0 21**
10	7. 92 861	7. 92 862	9. 99 998	50	10	8. 05 663	8. 05 666	9. 99 997	50
20	7. 93 108	7. 93 110	9. 99 998	40	20	8. 05 848	8. 05 851	9. 99 997	40
30	7. 93 354	7. 93 356	9. 99 998	30	30	8. 06 031	8. 06 034	9. 99 997	30
40	7. 93 599	7. 93 601	9. 99 998	20	40	8. 06 214	8. 06 217	9. 99 997	20
50	7. 93 842	7. 93 844	9. 99 998	10	50	8. 06 396	8. 06 399	9. 99 997	10
30 0	7. 94 084	7. 94 086	9. 99 998	**0 30**	**40 0**	8. 06 578	8. 06 581	9. 99 997	**0 20**
′ ″	log cos	log cot	log sin	″ ′	′ ″	log cos	log cot	log sin	″ ′

0°

′ ″	log sin	log tan	log cos	″ ′	′ ″	log sin	log tan	log cos	″ ′
40 0	8. 06 578	8. 06 581	9. 99 997	**0 20**	**50 0**	8. 16 268	8. 16 273	9. 99 995	**0 10**
10	8. 06 758	8. 06 761	9. 99 997	50	10	8. 16 413	8. 16 417	9. 99 995	50
20	8. 06 938	8. 06 941	9. 99 997	40	20	8. 16 557	8. 16 561	9. 99 995	40
30	8. 07 117	8. 07 120	9. 99 997	30	30	8. 16 700	8. 16 705	9. 99 995	30
40	8. 07 295	8. 07 299	9. 99 997	20	40	8. 16 843	8. 16 848	9. 99 995	20
50	8. 07 473	8. 07 476	9. 99 997	10	50	8. 16 986	8. 16 991	9. 99 995	10
41 0	8. 07 650	8. 07 653	9. 99 997	**0 19**	**51 0**	8. 17 128	8. 17 133	9. 99 995	**0 9**
10	8. 07 826	8. 07 829	9. 99 997	50	10	8. 17 270	8. 17 275	9. 99 995	50
20	8. 08 002	8. 08 005	9. 99 997	40	20	8. 17 411	8. 17 416	9. 99 995	40
30	8. 08 176	8. 08 180	9. 99 997	30	30	8. 17 552	8. 17 557	9. 99 995	30
40	8. 08 350	8. 08 354	9. 99 997	20	40	8. 17 692	8. 17 697	9. 99 995	20
50	8. 08 524	8. 08 527	9. 99 997	10	50	8. 17 832	8. 17 837	9. 99 995	10
42 0	8. 08 696	8. 08 700	9. 99 997	**0 18**	**52 0**	8. 17 971	8. 17 976	9. 99 995	**0 8**
10	8. 08 868	8. 08 872	9. 99 997	50	10	8. 18 110	8. 18 115	9. 99 995	50
20	8. 09 040	8. 09 043	9. 99 997	40	20	8. 18 249	8. 18 254	9. 99 995	40
30	8. 09 210	8. 09 214	9. 99 997	30	30	8. 18 387	8. 18 392	9. 99 995	30
40	8. 09 380	8. 09 384	9. 99 997	20	40	8. 18 524	8. 18 530	9. 99 995	20
50	8. 09 550	8. 09 553	9. 99 997	10	50	8. 18 662	8. 18 667	9. 99 995	10
43 0	8. 09 718	8. 09 722	9. 99 997	**0 17**	**53 0**	8. 18 798	8. 18 804	9. 99 995	**0 7**
10	8. 09 886	8. 09 890	9. 99 997	50	10	8. 18 935	8. 18 940	9. 99 995	50
20	8. 10 054	8. 10 057	9. 99 997	40	20	8. 19 071	8. 19 076	9. 99 995	40
30	8. 10 220	8. 10 224	9. 99 997	30	30	8. 19 206	8. 19 212	9. 99 995	30
40	8. 10 386	8. 10 390	9. 99 997	20	40	8. 19 341	8. 19 347	9. 99 995	20
50	8. 10 552	8. 10 555	9. 99 996	10	50	8. 19 476	8. 19 481	9. 99 995	10
44 0	8. 10 717	8. 10 720	9. 99 996	**0 16**	**54 0**	8. 19 610	8. 19 616	9. 99 995	**0 6**
10	8. 10 881	8. 10 884	9. 99 996	50	10	8. 19 744	8. 19 749	9. 99 995	50
20	8. 11 044	8. 11 048	9. 99 996	40	20	8. 19 877	8. 19 883	9. 99 995	40
30	8. 11 207	8. 11 211	9. 99 996	30	30	8. 20 010	8. 20 016	9. 99 995	30
40	8. 11 370	8. 11 373	9. 99 996	20	40	8. 20 143	8. 20 149	9. 99 995	20
50	8. 11 531	8. 11 535	9. 99 996	10	50	8. 20 275	8. 20 281	9. 99 994	10
45 0	8. 11 693	8. 11 696	9. 99 996	**0 15**	**55 0**	8. 20 407	8. 20 413	9. 99 994	**0 5**
10	8. 11 853	8. 11 857	9. 99 996	50	10	8. 20 538	8. 20 544	9. 99 994	50
20	8. 12 013	8. 12 017	9. 99 996	40	20	8. 20 669	8. 20 675	9. 99 994	40
30	8. 12 172	8. 12 176	9. 99 996	30	30	8. 20 800	8. 20 806	9. 99 994	30
40	8. 12 331	8. 12 335	9. 99 996	20	40	8. 20 930	8. 20 936	9. 99 994	20
50	8. 12 489	8. 12 493	9. 99 996	10	50	8. 21 060	8. 21 066	9. 99 994	10
46 0	8. 12 647	8. 12 651	9. 99 996	**0 14**	**56 0**	8. 21 189	8. 21 195	9. 99 994	**0 4**
10	8. 12 804	8. 12 808	9. 99 996	50	10	8. 21 319	8. 21 324	9. 99 994	50
20	8. 12 961	8. 12 965	9. 99 996	40	20	8. 21 447	8. 21 453	9. 99 994	40
30	8. 13 117	8. 13 121	9. 99 996	30	30	8. 21 576	8. 21 581	9. 99 994	30
40	8. 13 272	8. 13 276	9. 99 996	20	40	8. 21 703	8. 21 709	9. 99 944	20
50	8. 13 427	8. 13 431	9. 99 996	10	50	8. 21 831	8. 21 837	9. 99 994	10
47 0	8. 13 581	8. 13 585	9. 99 996	**0 13**	**57 0**	8. 21 958	8. 21 964	9. 99 994	**0 3**
10	8. 13 735	8. 13 739	9. 99 996	50	10	8. 22 085	8. 22 091	9. 99 994	50
20	8. 13 888	8. 13 892	9. 99 996	40	20	8. 22 211	8. 22 217	9. 99 994	40
30	8. 14 041	8. 14 045	9. 99 996	30	30	8. 22 337	8. 22 343	9. 99 994	30
40	8. 14 193	8. 14 197	9. 99 996	20	40	8. 22 463	8. 22 469	9. 99 994	20
50	8. 14 344	8. 14 348	9. 99 996	10	50	8. 22 588	8. 22 595	9. 99 994	10
48 0	8. 14 495	8. 14 500	9. 99 996	**0 12**	**58 0**	8. 22 713	8. 22 720	9. 99 994	**0 2**
10	8. 14 646	8. 14 650	9. 99 996	50	10	8. 22 838	8. 22 844	9. 99 994	50
20	8. 14 796	8. 14 800	9. 99 996	40	20	8. 22 962	8. 22 968	9. 99 994	40
30	8. 14 945	8. 14 950	9. 99 996	30	30	8. 23 086	8. 23 092	9. 99 994	30
40	8. 15 094	8. 15 099	9. 99 996	20	40	8. 23 210	8. 23 216	9. 99 994	20
50	8. 15 243	8. 15 247	9. 99 996	10	50	8. 23 333	8. 23 339	9. 99 994	10
49 0	8. 15 391	8. 15 395	9. 99 996	**0 11**	**59 0**	8. 23 456	8. 23 462	9. 99 994	**0 1**
10	8. 15 538	8. 15 543	9. 99 996	50	10	8. 23 578	8. 23 585	9. 99 994	50
20	8. 15 685	8. 15 690	9. 99 996	40	20	8. 23 700	8. 23 707	9. 99 994	40
30	8. 15 832	8. 15 836	9. 99 996	30	30	8. 23 822	8. 23 829	9. 99 993	30
40	8. 15 978	8. 15 982	9. 99 995	20	40	8. 23 944	8. 23 950	9. 99 993	20
50	8. 16 123	8. 16 128	9. 99 995	10	50	8. 24 065	8. 24 071	9. 99 993	10
50 0	8. 16 268	8. 16 273	9. 99 995	**0 10**	**60 0**	8. 24 186	8. 24 192	9. 99 993	**0 0**
′ ″	log cos	log cot	log sin	″ ′	′ ″	log cos	log cot	log sin	″ ′

89°

′ ″	log sin	log tan	log cos	″ ′	′ ″	log sin	log tan	log cos	″ ′
0 0	8. 24 186	8. 24 192	9. 99 993	0 60	10 0	8. 30 879	8. 30 888	9. 99 991	0 50
10	8. 24 306	8. 24 313	9. 99 993	50	10	8. 30 983	8. 30 992	9. 99 991	50
20	8. 24 426	8. 24 433	9. 99 993	40	20	8. 31 086	8. 31 095	9. 99 991	40
30	8. 24 546	8. 24 553	9. 99 993	30	30	8. 31 188	8. 31 198	9. 99 991	30
40	8. 24 665	8. 24 672	9. 99 993	20	40	8. 31 291	8. 31 300	9. 99 991	20
50	8. 24 785	8. 24 791	9. 99 993	10	50	8. 31 393	8. 31 403	9. 99 991	10
1 0	8. 24 903	8. 24 910	9. 99 993	0 59	11 0	8. 31 495	8. 31 505	9. 99 991	0 49
10	8. 25 022	8. 25 029	9. 99 993	50	10	8. 31 597	8. 31 606	9. 99 991	50
20	8. 25 140	8. 25 147	9. 99 993	40	20	8. 31 699	8. 31 708	9. 99 991	40
30	8. 25 258	8. 25 265	9. 99 993	30	30	8. 31 800	8. 31 809	9. 99 991	30
40	8. 25 375	8. 25 382	9. 99 993	20	40	8. 31 901	8. 31 911	9. 99 991	20
50	8. 25 493	8. 25 500	9. 99 993	10	50	8. 32 002	8. 32 012	9. 99 991	10
2 0	8. 25 609	8. 25 616	9. 99 993	0 58	12 0	8. 32 103	8. 32 112	9. 99 990	0 48
10	8. 25 726	8. 25 733	9. 99 993	50	10	8. 32 203	8. 32 213	9. 99 990	50
20	8. 25 842	8. 25 849	9. 99 993	40	20	8. 32 303	8. 32 313	9. 99 990	40
30	8. 25 958	8. 25 965	9. 99 993	30	30	8. 32 403	8. 32 413	9. 99 990	30
40	8. 26 074	8. 26 081	9. 99 993	20	40	8. 32 503	8. 32 513	9. 99 990	20
50	8. 26 189	8. 26 196	9. 99 993	10	50	8. 32 602	8. 32 612	9. 99 990	10
3 0	8. 26 304	8. 26 312	9. 99 993	0 57	13 0	8. 32 702	8. 32 711	9. 99 990	0 47
10	8. 26 419	8. 26 426	9. 99 993	50	10	8. 32 801	8. 32 811	9. 99 990	50
20	8. 26 533	8. 26 541	9. 99 993	40	20	8. 32 899	8. 32 909	9. 99 990	40
30	8. 26 648	8. 26 655	9. 99 993	30	30	8. 32 998	8. 33 008	9. 99 990	30
40	8. 26 761	8. 26 769	9. 99 993	20	40	8. 33 096	8. 33 106	9. 99 990	20
50	8. 26 875	8. 26 882	9. 99 993	10	50	8. 33 195	8. 33 205	9. 99 990	10
4 0	8. 26 988	8. 26 996	9. 99 992	0 56	14 0	8. 33 292	8. 33 302	9. 99 990	0 46
10	8. 27 101	8. 27 109	9. 99 992	50	10	8. 33 390	8. 33 400	9. 99 990	50
20	8. 27 214	8. 27 221	9. 99 992	40	20	8. 33 488	8. 33 498	9. 99 990	40
30	8. 27 326	8. 27 334	9. 99 992	30	30	8. 33 585	8. 33 595	9. 99 990	30
40	8. 27 438	8. 27 446	9. 99 992	20	40	8. 33 682	8. 33 692	9. 99 990	20
50	8. 27 550	8. 27 558	9. 99 992	10	50	8. 33 779	8. 33 789	9. 99 990	10
5 0	8. 27 661	8. 27 669	9. 99 992	0 55	15 0	8. 33 875	8. 33 886	9. 99 990	0 45
10	8. 27 773	8. 27 780	9. 99 992	50	10	8. 33 972	8. 33 982	9. 99 990	50
20	8. 27 883	8. 27 891	9. 99 992	40	20	8. 34 068	8. 34 078	9. 99 990	40
30	8. 27 994	8. 28 002	9. 99 992	30	30	8. 34 164	8. 34 174	9. 99 990	30
40	8. 28 104	8. 28 112	9. 99 992	20	40	8. 34 260	8. 34 270	9. 99 989	20
50	8. 28 215	8. 28 223	9. 99 992	10	50	8. 34 355	8. 34 366	9. 99 989	10
6 0	8. 28 324	8. 28 332	9. 99 992	0 54	16 0	8. 34 450	8. 34 461	9. 99 989	0 44
10	8. 28 434	8. 28 442	9. 99 992	50	10	8. 34 546	8. 34 556	9. 99 989	50
20	8. 28 543	8. 28 551	9. 99 992	40	20	8. 34 640	8. 34 651	9. 99 989	40
30	8. 28 652	8. 28 660	9. 99 992	30	30	8. 34 735	8. 34 746	9. 99 989	30
40	8. 28 761	8. 28 769	9. 99 992	20	40	8. 34 830	8. 34 840	9. 99 989	20
50	8. 28 869	8. 28 877	9. 99 992	10	50	8. 34 924	8. 34 935	9. 99 989	10
7 0	8. 28 977	8. 28 986	9. 99 992	0 53	17 0	8. 35 018	8. 35 029	9. 99 989	0 43
10	8. 29 085	8. 29 094	9. 99 992	50	10	8. 35 112	8. 35 123	9. 99 989	50
20	8. 29 193	8. 29 201	9. 99 992	40	20	8. 35 206	8. 35 217	9. 99 989	40
30	8. 29 300	8. 29 309	9. 99 992	30	30	8. 35 299	8. 35 310	9. 99 989	30
40	8. 29 407	8. 29 416	9. 99 992	20	40	8. 35 392	8. 35 403	9. 99 989	20
50	8. 29 514	8. 29 523	9. 99 992	10	50	8. 35 485	8. 35 497	9. 99 989	10
8 0	8. 29 621	8. 29 629	9. 99 992	0 52	18 0	8. 35 578	8. 35 590	9. 99 989	0 42
10	8. 29 727	8. 29 736	9. 99 991	50	10	8. 35 671	8. 35 682	9. 99 989	50
20	8. 29 833	8. 29 842	9. 99 991	40	20	8. 35 764	8. 35 775	9. 99 989	40
30	8. 29 939	8. 29 947	9. 99 991	30	30	8. 35 856	8. 35 867	9. 99 989	30
40	8. 30 044	8. 30 053	9. 99 991	20	40	8. 35 948	8. 35 959	9. 99 989	20
50	8. 30 150	8. 30 158	9. 99 991	10	50	8. 36 040	8. 36 051	9. 99 989	10
9 0	8. 30 255	8. 30 263	9. 99 991	0 51	19 0	8. 36 131	8. 36 143	9. 99 989	0 41
10	8. 30 359	8. 30 368	9. 99 991	50	10	8. 36 223	8. 36 235	9. 99 988	50
20	8. 30 464	8. 30 473	9. 99 991	40	20	8. 36 314	8. 36 326	9. 99 988	40
30	8. 30 568	8. 30 577	9. 99 991	30	30	8. 36 405	8. 36 417	9. 99 988	30
40	8. 30 672	8. 30 681	9. 99 991	20	40	8. 36 496	8. 36 508	9. 99 988	20
50	8. 30 776	8. 30 785	9. 99 991	10	50	8. 36 587	8. 36 599	9. 99 988	10
10 0	8. 30 879	8. 30 888	9. 99 991	0 50	20 0	8. 36 678	8. 36 689	9. 99 988	0 40
′ ″	log cos	log cot	log sin	″ ′	′ ″	log cos	log cot	log sin	″ ′

′ ″	log sin	log tan	log cos	″ ′	′ ″	log sin	log tan	log cos	″ ′
20 0	8. 36 678	8. 36 689	9. 99 988	**0 40**	**30 0**	8. 41 792	8. 41 807	9. 99 985	**0 30**
10	8. 36 768	8. 36 780	9. 99 988	50	10	8. 41 872	8. 41 887	9. 99 985	50
20	8. 36 858	8. 36 870	9. 99 988	40	20	8. 41 952	8. 41 967	9. 99 985	40
30	8. 36 948	8. 36 960	9. 99 988	30	30	8. 42 032	8. 42 048	9. 99 985	30
40	8. 37 038	8. 37 050	9. 99 988	20	40	8. 42 112	8. 42 127	9. 99 985	20
50	8. 37 128	8. 37 140	9. 99 988	10	50	8. 42 192	8. 42 207	9. 99 985	10
21 0	8. 37 217	8. 37 229	9. 99 988	**0 39**	**31 0**	8. 42 272	8. 42 287	9. 99 985	**0 29**
10	8. 37 306	8. 37 318	9. 99 988	50	10	8. 42 351	8. 42 366	9. 99 985	50
20	8. 37 395	8. 37 408	9. 99 988	40	20	8. 42 430	8. 42 446	9. 99 985	40
30	8. 37 484	8. 37 497	9. 99 988	30	30	8. 42 510	8. 42 525	9. 99 985	30
40	8. 37 573	8. 37 585	9. 99 988	20	40	8. 42 589	8. 42 604	9. 99 985	20
50	8. 37 662	8. 37 674	9. 99 988	10	50	8. 42 667	8. 42 683	9. 99 985	10
22 0	8. 37 750	8. 37 762	9. 99 988	**0 38**	**32 0**	8. 42 746	8. 42 762	9. 99 984	**0 28**
10	8. 37 838	8. 37 850	9. 99 988	50	10	8. 42 825	8. 42 840	9. 99 984	50
20	8. 37 926	8. 37 938	9. 99 988	40	20	8. 42 903	8. 42 919	9. 99 984	40
30	8. 38 014	8. 38 026	9. 99 987	30	30	8. 42 982	8. 42 997	9. 99 984	30
40	8. 38 101	8. 38 114	9. 99 987	20	40	8. 43 060	8. 43 075	9. 99 984	20
50	8. 38 189	8. 38 202	9. 99 987	10	50	8. 43 138	8. 43 154	9. 99 984	10
23 0	8. 38 276	8. 38 289	9. 99 987	**0 37**	**33 0**	8. 43 216	8. 43 232	9. 99 984	**0 27**
10	8. 38 363	8. 38 376	9. 99 987	50	10	8. 43 293	8. 43 309	9. 99 984	50
20	8. 38 450	8. 38 463	9. 99 987	40	20	8. 43 371	8. 43 387	9. 99 984	40
30	8. 38 537	8. 38 550	9. 99 987	30	30	8. 43 448	8. 43 464	9. 99 984	30
40	8. 38 624	8. 38 636	9. 99 987	20	40	8. 43 526	8. 43 542	9. 99 984	20
50	8. 38 710	8. 38 723	9. 99 987	10	50	8. 43 603	8. 43 619	9. 99 984	10
24 0	8. 38 796	8. 38 809	9. 99 987	**0 36**	**34 0**	8. 43 680	8. 43 696	9. 99 984	**0 26**
10	8. 38 882	8. 38 895	9. 99 987	50	10	8. 43 757	8. 43 773	9. 99 984	50
20	8. 38 968	8. 38 981	9. 99 987	40	20	8. 43 834	8. 43 850	9. 99 984	40
30	8. 39 054	8. 39 067	9. 99 987	30	30	8. 43 910	8. 43 927	9. 99 984	30
40	8. 39 139	8. 39 153	9. 99 987	20	40	8. 43 987	8. 44 003	9. 99 984	20
50	8. 39 225	8. 39 238	9. 99 987	10	50	8. 44 063	8. 44 080	9. 99 983	10
25 0	8. 39 310	8. 39 323	9. 99 987	**0 35**	**35 0**	8. 44 139	8. 44 156	9. 99 983	**0 25**
10	8. 39 395	8. 39 408	9. 99 987	50	10	8. 44 216	8. 44 232	9. 99 983	50
20	8. 39 480	8. 39 493	9. 99 987	40	20	8. 44 292	8. 44 308	9. 99 983	40
30	8. 39 565	8. 39 578	9. 99 987	30	30	8. 44 367	8. 44 384	9. 99 983	30
40	8. 39 649	8. 39 663	9. 99 987	20	40	8. 44 443	8. 44 460	9. 99 983	20
50	8. 39 734	8. 39 747	9. 99 986	10	50	8. 44 519	8. 44 536	9. 99 983	10
26 0	8. 39 818	8. 39 832	9. 99 986	**0 34**	**36 0**	8. 44 594	8. 44 611	9. 99 983	**0 24**
10	8. 39 902	8. 39 916	9. 99 986	50	10	8. 44 669	8. 44 686	9. 99 983	50
20	8. 39 986	8. 40 000	9. 99 986	40	20	8. 44 745	8. 44 762	9. 99 983	40
30	8. 40 070	8. 40 083	9. 99 986	30	30	8. 44 820	8. 44 837	9. 99 983	30
40	8. 40 153	8. 40 167	9. 99 986	20	40	8. 44 895	8. 44 912	9. 99 983	20
50	8. 40 237	8. 40 251	9. 99 986	10	50	8. 44 969	8. 44 987	9. 99 983	10
27 0	8. 40 320	8. 40 334	9. 99 986	**0 33**	**37 0**	8. 45 044	8. 45 061	9. 99 983	**0 23**
10	8. 40 403	8. 40 417	9. 99 986	50	10	8. 45 119	8. 45 136	9. 99 983	50
20	8. 40 486	8. 40 500	9. 99 986	40	20	8. 45 193	8. 45 210	9. 99 983	40
30	8. 40 569	8. 40 583	9. 99 986	30	30	8. 45 267	8. 45 285	9. 99 983	30
40	8. 40 651	8. 40 665	9. 99 986	20	40	8. 45 341	8. 45 359	9. 99 982	20
50	8. 40 734	8. 40 748	9. 99 986	10	50	8. 45 415	8. 45 433	9. 99 982	10
28 0	8. 40 816	8. 40 830	9. 99 986	**0 32**	**38 0**	8. 45 489	8. 45 507	9. 99 982	**0 22**
10	8. 40 898	8. 40 913	9. 99 986	50	10	8. 45 563	8. 45 581	9. 99 982	50
20	8. 40 980	8. 40 995	9. 99 986	40	20	8. 45 637	8. 45 655	9. 99 982	40
30	8. 41 062	8. 41 077	9. 99 986	30	30	8. 45 710	8. 45 728	9. 99 982	30
40	8. 41 144	8. 41 158	9. 99 986	20	40	8. 45 784	8. 45 802	9. 99 982	20
50	8. 41 225	8. 41 240	9. 99 986	10	50	8. 45 857	8. 45 875	9. 99 982	10
29 0	8. 41 307	8. 41 321	9. 99 985	**0 31**	**39 0**	8. 45 930	8. 45 948	9. 99 982	**0 21**
10	8. 41 388	8. 41 403	9. 99 985	50	10	8. 46 003	8. 46 021	9. 99 982	50
20	8. 41 469	8. 41 484	9. 99 985	40	20	8. 46 076	8. 46 094	9. 99 982	40
30	8. 41 550	8. 41 565	9. 99 985	30	30	8. 46 149	8. 46 167	9. 99 982	30
40	8. 41 631	8. 41 646	9. 99 985	20	40	8. 46 222	8. 46 240	9. 99 982	20
50	8. 41 711	8. 41 726	9. 99 985	10	50	8. 46 294	8. 46 312	9. 99 982	10
30 0	8. 41 792	8. 41 807	9. 99 985	**0 30**	**40 0**	8. 46 366	8. 46 385	9. 99 982	**0 20**
′ ″	log cos	log cot	log sin	″ ′	′ ″	log cos	log cot	log sin	″ ′

′ ″	log sin	log tan	log cos	″ ′	′ ″	log sin	log tan	log cos	″ ′
40 0	8.46 366	8.46 385	9.99 982	**0 20**	**50 0**	8.50 504	8.50 527	9.99 978	**0 10**
10	8.46 439	8.46 457	9.99 982	50	10	8.50 570	8.50 593	9.99 978	50
20	8.46 511	8.46 529	9.99 982	40	20	8.50 636	8.50 658	9.99 978	40
30	8.46 583	8.46 602	9.99 981	30	30	8.50 701	8.50 724	9.99 978	30
40	8.46 655	8.46 674	9.99 981	20	40	8.50 767	8.50 789	9.99 977	20
50	8.46 727	8.46 745	9.99 981	10	50	8.50 832	8.50 855	9.99 977	10
41 0	8.46 799	8.46 817	9.99 981	**0 19**	**51 0**	8.50 897	8.50 920	9.99 977	**0 9**
10	8.46 870	8.46 889	9.99 981	50	10	8.50 963	8.50 985	9.99 977	50
20	8.46 942	8.46 960	9.99 981	40	20	8.51 028	8.51 050	9.99 977	40
30	8.47 013	8.47 032	9.99 981	30	30	8.51 092	8.51 115	9.99 977	30
40	8.47 084	8.47 103	9.99 981	20	40	8.51 157	8.51 180	9.99 977	20
50	8.47 155	8.47 174	9.99 981	10	50	8.51 222	8.51 245	9.99 977	10
42 0	8.47 226	8.47 245	9.99 981	**0 18**	**52 0**	8.51 287	8.51 310	9.99 977	**0 8**
10	8.47 297	8.47 316	9.99 981	50	10	8.51 351	8.51 374	9.99 977	50
20	8.47 368	8.47 387	9.99 981	40	20	8.51 416	8.51 439	9.99 977	40
30	8.47 439	8.47 458	9.99 981	30	30	8.51 480	8.51 503	9.99 977	30
40	8.47 509	8.47 528	9.99 981	20	40	8.51 544	8.51 568	9.99 977	20
50	8.47 580	8.47 599	9.99 981	10	50	8.51 609	8.51 632	9.99 977	10
43 0	8.47 650	8.47 669	9.99 981	**0 17**	**53 0**	8.51 673	8.51 696	9.99 977	**0 7**
10	8.47 720	8.47 740	9.99 980	50	10	8.51 737	8.51 760	9.99 976	50
20	8.47 790	8.47 810	9.99 980	40	20	8.51 801	8.51 824	9.99 976	40
30	8.47 860	8.47 880	9.99 980	30	30	8.51 864	8.51 888	9.99 976	30
40	8.47 930	8.47 950	9.99 980	20	40	8.51 928	8.51 952	9.99 976	20
50	8.48 000	8.48 020	9.99 980	10	50	8.51 992	8.52 015	9.99 976	10
44 0	8.48 069	8.48 090	9.99 980	**0 16**	**54 0**	8.52 055	8.52 079	9.99 976	**0 6**
10	8.48 139	8.48 159	9.99 980	50	10	8.52 119	8.52 143	9.99 976	50
20	8.48 208	8.48 228	9.99 980	40	20	8.52 182	8.52 206	9.99 976	40
30	8.48 278	8.48 298	9.99 980	30	30	8.52 245	8.52 269	9.99 976	30
40	8.48 347	8.48 367	9.99 980	20	40	8.52 308	8.52 332	9.99 976	20
50	8.48 416	8.48 436	9.99 980	10	50	8.52 371	8.52 396	9.99 976	10
45 0	8.48 485	8.48 505	9.99 980	**0 15**	**55 0**	8.52 434	8.52 459	9.99 976	**0 5**
10	8.48 554	8.48 574	9.99 980	50	10	8.52 497	8.52 522	9.99 976	50
20	8.48 622	8.48 643	9.99 980	40	20	8.52 560	8.52 584	9.99 976	40
30	8.48 691	8.48 711	9.99 980	30	30	8.52 623	8.52 647	9.99 975	30
40	8.48 760	8.48 780	9.99 979	20	40	8.52 685	8.52 710	9.99 975	20
50	8.48 828	8.48 849	9.99 979	10	50	8.52 748	8.52 772	9.99 975	10
46 0	8.48 896	8.48 917	9.99 979	**0 14**	**56 0**	8.52 810	8.52 835	9.99 975	**0 4**
10	8.48 965	8.48 985	9.99 979	50	10	8.52 872	8.52 897	9.99 975	50
20	8.49 033	8.49 053	9.99 979	40	20	8.52 935	8.52 960	9.99 975	40
30	8.49 101	8.49 121	9.99 979	30	30	8.52 997	8.53 022	9.99 975	30
40	8.49 169	8.49 189	9.99 979	20	40	8.53 059	8.53 084	9.99 975	20
50	8.49 236	8.49 257	9.99 979	10	50	8.53 121	8.53 146	9.99 975	10
47 0	8.49 304	8.49 325	9.99 979	**0 13**	**57 0**	8.53 183	8.53 208	9.99 975	**0 3**
10	8.49 372	8.49 393	9.99 979	50	10	8.53 245	8.53 270	9.99 975	50
20	8.49 439	8.49 460	9.99 979	40	20	8.53 306	8.53 332	9.99 975	40
30	8.49 506	8.49 528	9.99 979	30	30	8.53 368	8.53 393	9.99 975	30
40	8.49 574	8.49 595	9.99 979	20	40	8.53 429	8.53 455	9.99 975	20
50	8.49 641	8.49 662	9.99 979	10	50	8.53 491	8.53 516	9.99 974	10
48 0	8.49 708	8.49 729	9.99 979	**0 12**	**58 0**	8.53 552	8.53 578	9.99 974	**0 2**
10	8.49 775	8.49 796	9.99 979	50	10	8.53 614	8.53 639	9.99 974	50
20	8.49 842	8.49 863	9.99 978	40	20	8.53 675	8.53 700	9.99 974	40
30	8.49 908	8.49 930	9.99 978	30	30	8.53 736	8.53 762	9.99 974	30
40	8.49 975	8.49 997	9.99 978	20	40	8.53 797	8.53 823	9.99 974	20
50	8.50 042	8.50 063	9.99 978	10	50	8.53 858	8.53 884	9.99 974	10
49 0	8.50 108	8.50 130	9.99 978	**0 11**	**59 0**	8.53 919	8.53 945	9.99 974	**0 1**
10	8.50 174	8.50 196	9.99 978	50	10	8.53 979	8.54 005	9.99 974	50
20	8.50 241	8.50 263	9.99 978	40	20	8.54 040	8.54 066	9.99 974	40
30	8.50 307	8.50 329	9.99 978	30	30	8.54 101	8.54 127	9.99 974	30
40	8.50 373	8.50 395	9.99 978	20	40	8.54 161	8.54 187	9.99 974	20
50	8.50 439	8.50 461	9.99 978	10	50	8.54 222	8.54 248	9.99 974	10
50 0	8.50 504	8.50 527	9.99 978	**0 10**	**60 0**	8.54 282	8.54 308	9.99 974	**0 0**
′ ″	log cos	log cot	log sin	″ ′	′ ″	log cos	log cot	log sin	″ ′

1°

′	log sin	log tan	log cot	log cos	′
	−8	−8	−11	−9	
0	24 186	24 192	75 808	99 993	60
1	24 903	24 910	75 090	99 993	59
2	25 609	25 616	74 384	99 993	58
3	26 304	26 312	73 688	99 993	57
4	26 988	26 996	73 004	99 992	56
5	27 661	27 669	72 331	99 992	55
6	28 324	28 332	71 668	99 992	54
7	28 977	28 986	71 014	99 992	53
8	29 621	29 629	70 371	99 992	52
9	30 255	30 263	69 737	99 991	51
10	30 879	30 888	69 112	99 991	50
11	31 495	31 505	68 495	99 991	49
12	32 103	32 112	67 888	99 990	48
13	32 702	32 711	67 289	99 990	47
14	33 292	33 302	66 698	99 990	46
15	33 875	33 886	66 114	99 990	45
16	34 450	34 461	65 539	99 989	44
17	35 018	35 029	64 971	99 989	43
18	35 578	35 590	64 410	99 989	42
19	36 131	36 143	63 857	99 989	41
20	36 678	36 689	63 311	99 988	40
21	37 217	37 229	62 771	99 988	39
22	37 750	37 762	62 238	99 988	38
23	38 276	38 289	61 711	99 987	37
24	38 796	38 809	61 191	99 987	36
25	39 310	39 323	60 677	99 987	35
26	39 818	39 832	60 168	99 986	34
27	40 320	40 334	59 666	99 986	33
28	40 816	40 830	59 170	99 986	32
29	41 307	41 321	58 679	99 985	31
30	41 792	41 807	58 193	99 985	30
31	42 272	42 287	57 713	99 985	29
32	42 746	42 762	57 238	99 984	28
33	43 216	43 232	56 768	99 984	27
34	43 680	43 696	56 304	99 984	26
35	44 139	44 156	55 844	99 983	25
36	44 594	44 611	55 389	99 983	24
37	45 044	45 061	54 939	99 983	23
38	45 489	45 507	54 493	99 982	22
39	45 930	45 948	54 052	99 982	21
40	46 366	46 385	53 615	99 982	20
41	46 799	46 817	53 183	99 981	19
42	47 226	47 245	52 755	99 981	18
43	47 650	47 669	52 331	99 981	17
44	48 069	48 089	51 911	99 980	16
45	48 485	48 505	51 495	99 980	15
46	48 896	48 917	51 083	99 979	14
47	49 304	49 325	50 675	99 979	13
48	49 708	49 729	50 271	99 979	12
49	50 108	50 130	49 870	99 978	11
50	50 504	50 527	49 473	99 978	10
51	50 897	50 920	49 080	99 977	9
52	51 287	51 310	48 690	99 977	8
53	51 673	51 696	48 304	99 977	7
54	52 055	52 079	47 921	99 976	6
55	52 434	52 459	47 541	99 976	5
56	52 810	52 835	47 165	99 975	4
57	53 183	53 208	46 792	99 975	3
58	53 552	53 578	46 422	99 974	2
59	53 919	53 945	46 055	99 974	1
60	54 282	54 308	45 692	99 974	0
	−8	−8	−11	−9	
′	log cos	log cot	log tan	log sin	′

88°

2°

′	log sin	log tan	log cot	log cos	′
	−8	−8	−11	−9	
0	54 282	54 308	45 692	99 974	60
1	54 642	54 669	45 331	99 973	59
2	54 999	55 027	44 973	99 973	58
3	55 354	55 382	44 618	99 972	57
4	55 705	55 734	44 266	99 972	56
5	56 054	56 083	43 917	99 971	55
6	56 400	56 429	43 571	99 971	54
7	56 743	56 773	43 227	99 970	53
8	57 084	57 114	42 886	99 970	52
9	57 421	57 452	42 548	99 969	51
10	57 757	57 788	42 212	99 969	50
11	58 089	58 121	41 879	99 968	49
12	58 419	58 451	41 549	99 968	48
13	58 747	58 779	41 221	99 967	47
14	59 072	59 105	40 895	99 967	46
15	59 395	59 428	40 572	99 967	45
16	59 715	59 749	40 251	99 966	44
17	60 033	60 068	39 932	99 966	43
18	60 349	60 384	39 616	99 965	42
19	60 662	60 698	39 302	99 964	41
20	60 973	61 009	38 991	99 964	40
21	61 282	61 319	38 681	99 963	39
22	61 589	61 626	38 374	99 963	38
23	61 894	61 931	38 069	99 962	37
24	62 196	62 234	37 766	99 962	36
25	62 497	62 535	37 465	99 961	35
26	62 795	62 834	37 166	99 961	34
27	63 091	63 131	36 869	99 960	33
28	63 385	63 426	36 574	99 960	32
29	63 678	63 718	36 282	99 959	31
30	63 968	64 009	35 991	99 959	30
31	64 256	64 298	35 702	99 958	29
32	64 543	64 585	35 415	99 958	28
33	64 827	64 870	35 130	99 957	27
34	65 110	65 154	34 846	99 956	26
35	65 391	65 435	34 565	99 956	25
36	65 670	65 715	34 285	99 955	24
37	65 947	65 993	34 007	99 955	23
38	66 223	66 269	33 731	99 954	22
39	66 497	66 543	33 457	99 954	21
40	66 769	66 816	33 184	99 953	20
41	67 039	67 087	32 913	99 952	19
42	67 308	67 356	32 644	99 952	18
43	67 575	67 624	32 376	99 951	17
44	67 841	67 890	32 110	99 951	16
45	68 104	68 154	31 846	99 950	15
46	68 367	68 417	31 583	99 949	14
47	68 627	68 678	31 322	99 949	13
48	68 886	68 938	31 062	99 948	12
49	69 144	69 196	30 804	99 948	11
50	69 400	69 453	30 547	99 947	10
51	69 654	69 708	30 292	99 946	9
52	69 907	69 962	30 038	99 946	8
53	70 159	70 214	29 786	99 945	7
54	70 409	70 465	29 535	99 944	6
55	70 658	70 714	29 286	99 944	5
56	70 905	70 962	29 038	99 943	4
57	71 151	71 208	28 792	99 942	3
58	71 395	71 453	28 547	99 942	2
59	71 638	71 697	28 303	99 941	1
60	71 880	71 940	28 060	99 940	0
	−8	−8	−11	−9	
′	log cos	log cot	log tan	log sin	′

87°

3°

′	log sin	log tan	log cot	log cos	′
	8	8	11	9	
0	71 880	71 940	28 060	99 940	60
1	72 120	72 181	27 819	99 940	59
2	72 359	72 420	27 580	99 939	58
3	72 597	72 659	27 341	99 938	57
4	72 834	72 896	27 104	99 938	56
5	73 069	73 132	26 868	99 937	55
6	73 303	73 366	26 634	99 936	54
7	73 535	73 600	26 400	99 936	53
8	73 767	73 832	26 168	99 935	52
9	73 997	74 063	25 937	99 934	51
10	74 226	74 292	25 708	99 934	50
11	74 454	74 521	25 479	99 933	49
12	74 680	74 748	25 252	99 932	48
13	74 906	74 974	25 026	99 932	47
14	75 130	75 199	24 801	99 931	46
15	75 353	75 423	24 577	99 930	45
16	75 575	75 645	24 355	99 929	44
17	75 795	75 867	24 133	99 929	43
18	76 015	76 087	23 913	99 928	42
19	76 234	76 306	23 694	99 927	41
20	76 451	76 525	23 475	99 926	40
21	76 667	76 742	23 258	99 926	39
22	76 883	76 958	23 042	99 925	38
23	77 097	77 173	22 827	99 924	37
24	77 310	77 387	22 613	99 923	36
25	77 522	77 600	22 400	99 923	35
26	77 733	77 811	22 189	99 922	34
27	77 943	78 022	21 978	99 921	33
28	78 152	78 232	21 768	99 920	32
29	78 360	78 441	21 559	99 920	31
30	78 568	78 649	21 351	99 919	30
31	78 774	78 855	21 145	99 918	29
32	78 979	79 061	20 939	99 917	28
33	79 183	79 266	20 734	99 917	27
34	79 386	79 470	20 530	99 916	26
35	79 588	79 673	20 327	99 915	25
36	79 789	79 875	20 125	99 914	24
37	79 990	80 076	19 924	99 913	23
38	80 189	80 277	19 723	99 913	22
39	80 388	80 476	19 524	99 912	21
40	80 585	80 674	19 326	99 911	20
41	80 782	80 872	19 128	99 910	19
42	80 978	81 068	18 932	99 909	18
43	81 173	81 264	18 736	99 909	17
44	81 367	81 459	18 541	99 908	16
45	81 560	81 653	18 347	99 907	15
46	81 752	81 846	18 154	99 906	14
47	81 944	82 038	17 962	99 905	13
48	82 134	82 230	17 770	99 904	12
49	82 324	82 420	17 580	99 904	11
50	82 513	82 610	17 390	99 903	10
51	82 701	82 799	17 201	99 902	9
52	82 888	82 987	17 013	99 901	8
53	83 075	83 175	16 825	99 900	7
54	83 261	83 361	16 639	99 899	6
55	83 446	83 547	16 453	99 898	5
56	83 630	83 732	16 268	99 898	4
57	83 813	83 916	16 084	99 897	3
58	83 996	84 100	15 900	99 896	2
59	84 177	84 282	15 718	99 895	1
60	84 358	84 464	15 536	99 894	0
	8	8	11	9	
′	log cos	log cot	log tan	log sin	′

86°

4°

′	log sin	log tan	log cot	log cos	′
	8	8	11	9	
0	84 358	84 464	15 536	99 894	60
1	84 539	84 646	15 354	99 893	59
2	84 718	84 826	15 174	99 892	58
3	84 897	85 006	14 994	99 891	57
4	85 075	85 185	14 815	99 891	56
5	85 252	85 363	14 637	99 890	55
6	85 429	85 540	14 460	99 889	54
7	85 605	85 717	14 283	99 888	53
8	85 780	85 893	14 107	99 887	52
9	85 955	86 069	13 931	99 886	51
10	86 128	86 243	13 757	99 885	50
11	86 301	86 417	13 583	99 884	49
12	86 474	86 591	13 409	99 883	48
13	86 645	86 763	13 237	99 882	47
14	86 816	86 935	13 065	99 881	46
15	86 987	87 106	12 894	99 880	45
16	87 156	87 277	12 723	99 879	44
17	87 325	87 447	12 553	99 879	43
18	87 494	87 616	12 384	99 878	42
19	87 661	87 785	12 215	99 877	41
20	87 829	87 953	12 047	99 876	40
21	87 995	88 120	11 880	99 875	39
22	88 161	88 287	11 713	99 874	38
23	88 326	88 453	11 547	99 873	37
24	88 490	88 618	11 382	99 872	36
25	88 654	88 783	11 217	99 871	35
26	88 817	88 948	11 052	99 870	34
27	88 980	89 111	10 889	99 869	33
28	89 142	89 274	10 726	99 868	32
29	89 304	89 437	10 563	99 867	31
30	89 464	89 598	10 402	99 866	30
31	89 625	89 760	10 240	99 865	29
32	89 784	89 920	10 080	99 864	28
33	89 943	90 080	09 920	99 863	27
34	90 102	90 240	09 760	99 862	26
35	90 260	90 399	09 601	99 861	25
36	90 417	90 557	09 443	99 860	24
37	90 574	90 715	09 285	99 859	23
38	90 730	90 872	09 128	99 858	22
39	90 885	91 029	08 971	99 857	21
40	91 040	91 185	08 815	99 856	20
41	91 195	91 340	08 660	99 855	19
42	91 349	91 495	08 505	99 854	18
43	91 502	91 650	08 350	99 853	17
44	91 655	91 803	08 197	99 852	16
45	91 807	91 957	08 043	99 851	15
46	91 959	92 110	07 890	99 850	14
47	92 110	92 262	07 738	99 848	13
48	92 261	92 414	07 586	99 847	12
49	92 411	92 565	07 435	99 846	11
50	92 561	92 716	07 284	99 845	10
51	92 710	92 866	07 134	99 844	9
52	92 859	93 016	06 984	99 843	8
53	93 007	93 165	06 835	99 842	7
54	93 154	93 313	06 687	99 841	6
55	93 301	93 462	06 538	99 840	5
56	93 448	93 609	06 391	99 839	4
57	93 594	93 756	06 244	99 838	3
58	93 740	93 903	06 097	99 837	2
59	93 885	94 049	05 951	99 836	1
60	94 030	94 195	05 805	99 834	0
	8	8	11	9	
′	log cos	log cot	log tan	log sin	′

85°

5°

′	log sin	log tan	log cot	log cos	′
	8	8	11	9	
0	94 030	94 195	05 805	99 834	60
1	94 174	94 340	05 660	99 833	59
2	94 317	94 485	05 515	99 832	58
3	94 461	94 630	05 370	99 831	57
4	94 603	94 773	05 227	99 830	56
5	94 746	94 917	05 083	99 829	55
6	94 887	95 060	04 940	99 828	54
7	95 029	95 202	04 798	99 827	53
8	95 170	95 344	04 656	99 825	52
9	95 310	95 486	04 514	99 824	51
10	95 450	95 627	04 373	99 823	50
11	95 589	95 767	04 233	99 822	49
12	95 728	95 908	04 092	99 821	48
13	95 867	96 047	03 953	99 820	47
14	96 005	96 187	03 813	99 819	46
15	96 143	96 325	03 675	99 817	45
16	96 280	96 464	03 536	99 816	44
17	96 417	96 602	03 398	99 815	43
18	96 553	96 739	03 261	99 814	42
19	96 689	96 877	03 123	99 813	41
20	96 825	97 013	02 987	99 812	40
21	96 960	97 150	02 850	99 810	39
22	97 095	97 285	02 715	99 809	38
23	97 229	97 421	02 579	99 808	37
24	97 363	97 556	02 444	99 807	36
25	97 496	97 691	02 309	99 806	35
26	97 629	97 825	02 175	99 804	34
27	97 762	97 959	02 041	99 803	33
28	97 894	98 092	01 908	99 802	32
29	98 026	98 225	01 775	99 801	31
30	98 157	98 358	01 642	99 800	30
31	98 288	98 490	01 510	99 798	29
32	98 419	98 622	01 378	99 797	28
33	98 549	98 753	01 247	99 796	27
34	98 679	98 884	01 116	99 795	26
35	98 808	99 015	00 985	99 793	25
36	98 937	99 145	00 855	99 792	24
37	99 066	99 275	00 725	99 791	23
38	99 194	99 405	00 595	99 790	22
39	99 322	99 534	00 466	99 788	21
40	99 450	99 662	00 338	99 787	20
41	99 577	99 791	00 209	99 786	19
42	99 704	99 919	00 081	99 785	18
43	99 830	00 046	99 954	99 783	17
44	99 956	00 174	99 826	99 782	16
45	00 082	00 301	99 699	99 781	15
46	00 207	00 427	99 573	99 780	14
47	00 332	00 553	99 447	99 778	13
48	00 456	00 679	99 321	99 777	12
49	00 581	00 805	99 195	99 776	11
50	00 704	00 930	99 070	99 775	10
51	00 828	01 055	98 945	99 773	9
52	00 951	01 179	98 821	99 772	8
53	01 074	01 303	98 697	99 771	7
54	01 196	01 427	98 573	99 769	6
55	01 318	01 550	98 450	99 768	5
56	01 440	01 673	98 327	99 767	4
57	01 561	01 796	98 204	99 765	3
58	01 682	01 918	98 082	99 764	2
59	01 803	02 040	97 960	99 763	1
60	01 923	02 162	97 838	99 761	0
	9	9	10	9	
′	log cos	log cot	log tan	log sin	′

6°

′	log sin	log tan	log cot	log cos	′
	9	9	10	9	
0	01 923	02 162	97 838	99 761	60
1	02 043	02 283	97 717	99 760	59
2	02 163	02 404	97 596	99 759	58
3	02 283	02 525	97 475	99 757	57
4	02 402	02 645	97 355	99 756	56
5	02 520	02 766	97 234	99 755	55
6	02 639	02 885	97 115	99 753	54
7	02 757	03 005	96 995	99 752	53
8	02 874	03 124	96 876	99 751	52
9	02 992	03 242	96 758	99 749	51
10	03 109	03 361	96 639	99 748	50
11	03 226	03 479	96 521	99 747	49
12	03 342	03 597	96 403	99 745	48
13	03 458	03 714	96 286	99 744	47
14	03 574	03 832	96 168	99 742	46
15	03 690	03 948	96 052	99 741	45
16	03 805	04 065	95 935	99 740	44
17	03 920	04 181	95 819	99 738	43
18	04 034	04 297	95 703	99 737	42
19	04 149	04 413	95 587	99 736	41
20	04 262	04 528	95 472	99 734	40
21	04 376	04 643	95 357	99 733	39
22	04 490	04 758	95 242	99 731	38
23	04 603	04 873	95 127	99 730	37
24	04 715	04 987	95 013	99 728	36
25	04 828	05 101	94 899	99 727	35
26	04 940	05 214	94 786	99 726	34
27	05 052	05 328	94 672	99 724	33
28	05 164	05 441	94 559	99 723	32
29	05 275	05 553	94 447	99 721	31
30	05 386	05 666	94 334	99 720	30
31	05 497	05 778	94 222	99 718	29
32	05 607	05 890	94 110	99 717	28
33	05 717	06 002	93 998	99 716	27
34	05 827	06 113	93 887	99 714	26
35	05 937	06 224	93 776	99 713	25
36	06 046	06 335	93 665	99 711	24
37	06 155	06 445	93 555	99 710	23
38	06 264	06 556	93 444	99 708	22
39	06 372	06 666	93 334	99 707	21
40	06 481	06 775	93 225	99 705	20
41	06 589	06 885	93 115	99 704	19
42	06 696	06 994	93 006	99 702	18
43	06 804	07 103	92 897	99 701	17
44	06 911	07 211	92 789	99 699	16
45	07 018	07 320	92 680	99 698	15
46	07 124	07 428	92 572	99 696	14
47	07 231	07 536	92 464	99 695	13
48	07 337	07 643	92 357	99 693	12
49	07 442	07 751	92 249	99 692	11
50	07 548	07 858	92 142	99 690	10
51	07 653	07 964	92 036	99 689	9
52	07 758	08 071	91 929	99 687	8
53	07 863	08 177	91 823	99 686	7
54	07 968	08 283	91 717	99 684	6
55	08 072	08 389	91 611	99 683	5
56	08 176	08 495	91 505	99 681	4
57	08 280	08 600	91 400	99 680	3
58	08 383	08 705	91 295	99 678	2
59	08 486	08 810	91 190	99 677	1
60	08 589	08 914	91 086	99 675	0
	9	9	10	9	
′	log cos	log cot	log tan	log sin	′

7°

′	log sin	log tan	log cot	log cos	′
	9	9	10	9	
0	08 589	08 914	91 086	99 675	60
1	08 692	09 019	90 981	99 674	59
2	08 795	09 123	90 877	99 672	58
3	08 897	09 227	90 773	99 670	57
4	08 999	09 330	90 670	99 669	56
5	09 101	09 434	90 566	99 667	55
6	09 202	09 537	90 463	99 666	54
7	09 304	09 640	90 360	99 664	53
8	09 405	09 742	90 258	99 663	52
9	09 506	09 845	90 155	99 661	51
10	09 606	09 947	90 053	99 659	50
11	09 707	10 049	89 951	99 658	49
12	09 807	10 150	89 850	99 656	48
13	09 907	10 252	89 748	99 655	47
14	10 006	10 353	89 647	99 653	46
15	10 106	10 454	89 546	99 651	45
16	10 205	10 555	89 445	99 650	44
17	10 304	10 656	89 344	99 648	43
18	10 402	10 756	89 244	99 647	42
19	10 501	10 856	89 144	99 645	41
20	10 599	10 956	89 044	99 643	40
21	10 697	11 056	88 944	99 642	39
22	10 795	11 155	88 845	99 640	38
23	10 893	11 254	88 746	99 638	37
24	10 990	11 353	88 647	99 637	36
25	11 087	11 452	88 548	99 635	35
26	11 184	11 551	88 449	99 633	34
27	11 281	11 649	88 351	99 632	33
28	11 377	11 747	88 253	99 630	32
29	11 474	11 845	88 155	99 629	31
30	11 570	11 943	88 057	99 627	30
31	11 666	12 040	87 960	99 625	29
32	11 761	12 138	87 862	99 624	28
33	11 857	12 235	87 765	99 622	27
34	11 952	12 332	87 668	99 620	26
35	12 047	12 428	87 572	99 618	25
36	12 142	12 525	87 475	99 617	24
37	12 236	12 621	87 379	99 615	23
38	12 331	12 717	87 283	99 613	22
39	12 425	12 813	87 187	99 612	21
40	12 519	12 909	87 091	99 610	20
41	12 612	13 004	86 996	99 608	19
42	12 706	13 099	86 901	99 607	18
43	12 799	13 194	86 806	99 605	17
44	12 892	13 289	86 711	99 603	16
45	12 985	13 384	86 616	99 601	15
46	13 078	13 478	86 522	99 600	14
47	13 171	13 573	86 427	99 598	13
48	13 263	13 667	86 333	99 596	12
49	13 355	13 761	86 239	99 595	11
50	13 447	13 854	86 146	99 593	10
51	13 539	13 948	86 052	99 591	9
52	13 630	14 041	85 959	99 589	8
53	13 722	14 134	85 866	99 588	7
54	13 813	14 227	85 773	99 586	6
55	13 904	14 320	85 680	99 584	5
56	13 994	14 412	85 588	99 582	4
57	14 085	14 504	85 496	99 581	3
58	14 175	14 597	85 403	99 579	2
59	14 266	14 688	85 312	99 577	1
60	14 356	14 780	85 220	99 575	0
	9	9	10	9	
′	log cos	log cot	log tan	log sin	′

82°

8°

′	log sin	log tan	log cot	log cos	′
	9	9	10	9	
0	14 356	14 780	85 220	99 575	60
1	14 445	14 872	85 128	99 574	59
2	14 535	14 963	85 037	99 572	58
3	14 624	15 054	84 946	99 570	57
4	14 714	15 145	84 855	99 568	56
5	14 803	15 236	84 764	99 566	55
6	14 891	15 327	84 673	99 565	54
7	14 980	15 417	84 583	99 563	53
8	15 069	15 508	84 492	99 561	52
9	15 157	15 598	84 402	99 559	51
10	15 245	15 688	84 312	99 557	50
11	15 333	15 777	84 223	99 556	49
12	15 421	15 867	84 133	99 554	48
13	15 508	15 956	84 044	99 552	47
14	15 596	16 046	83 954	99 550	46
15	15 683	16 135	83 865	99 548	45
16	15 770	16 224	83 776	99 546	44
17	15 857	16 312	83 688	99 545	43
18	15 944	16 401	83 599	99 543	42
19	16 030	16 489	83 511	99 541	41
20	16 116	16 577	83 423	99 539	40
21	16 203	16 665	83 335	99 537	39
22	16 289	16 753	83 247	99 535	38
23	16 374	16 841	83 159	99 533	37
24	16 460	16 928	83 072	99 532	36
25	16 545	17 016	82 984	99 530	35
26	16 631	17 103	82 897	99 528	34
27	16 716	17 190	82 810	99 526	33
28	16 801	17 277	82 723	99 524	32
29	16 886	17 363	82 637	99 522	31
30	16 970	17 450	82 550	99 520	30
31	17 055	17 536	82 464	99 518	29
32	17 139	17 622	82 378	99 517	28
33	17 223	17 708	82 292	99 515	27
34	17 307	17 794	82 206	99 513	26
35	17 391	17 880	82 120	99 511	25
36	17 474	17 965	82 035	99 509	24
37	17 558	18 051	81 949	99 507	23
38	17 641	18 136	81 864	99 505	22
39	17 724	18 221	81 779	99 503	21
40	17 807	18 306	81 694	99 501	20
41	17 890	18 391	81 609	99 499	19
42	17 973	18 475	81 525	99 497	18
43	18 055	18 560	81 440	99 495	17
44	18 137	18 644	81 356	99 494	16
45	18 220	18 728	81 272	99 492	15
46	18 302	18 812	81 188	99 490	14
47	18 383	18 896	81 104	99 488	13
48	18 465	18 979	81 021	99 486	12
49	18 547	19 063	80 937	99 484	11
50	18 628	19 146	80 854	99 482	10
51	18 709	19 229	80 771	99 480	9
52	18 790	19 312	80 688	99 478	8
53	18 871	19 395	80 605	99 476	7
54	18 952	19 478	80 522	99 474	6
55	19 033	19 561	80 439	99 472	5
56	19 113	19 643	80 357	99 470	4
57	19 193	19 725	80 275	99 468	3
58	19 273	19 807	80 193	99 466	2
59	19 353	19 889	80 111	99 464	1
60	19 433	19 971	80 029	99 462	0
	9	9	10	9	
′	log cos	log cot	log tan	log sin	′

81°

9°

′	log sin	log tan	log cot	log cos	′
	9	9	10	9	
0	19 433	19 971	80 029	99 462	60
1	19 513	20 053	79 947	99 460	59
2	19 592	20 134	79 866	99 458	58
3	19 672	20 216	79 784	99 456	57
4	19 751	20 297	79 703	99 454	56
5	19 830	20 378	79 622	99 452	55
6	19 909	20 459	79 541	99 450	54
7	19 988	20 540	79 460	99 448	53
8	20 067	20 621	79 379	99 446	52
9	20 145	20 701	79 299	99 444	51
10	20 223	20 782	79 218	99 442	50
11	20 302	20 862	79 138	99 440	49
12	20 380	20 942	79 058	99 438	48
13	20 458	21 022	78 978	99 436	47
14	20 535	21 102	78 898	99 434	46
15	20 613	21 182	78 818	99 432	45
16	20 691	21 261	78 739	99 429	44
17	20 768	21 341	78 659	99 427	43
18	20 845	21 420	78 580	99 425	42
19	20 922	21 499	78 501	99 423	41
20	20 999	21 578	78 422	99 421	40
21	21 076	21 657	78 343	99 419	39
22	21 153	21 736	78 264	99 417	38
23	21 229	21 814	78 186	99 415	37
24	21 306	21 893	78 107	99 413	36
25	21 382	21 971	78 029	99 411	35
26	21 458	22 049	77 951	99 409	34
27	21 534	22 127	77 873	99 407	33
28	21 610	22 205	77 795	99 404	32
29	21 685	22 283	77 717	99 402	31
30	21 761	22 361	77 639	99 400	30
31	21 836	22 438	77 562	99 398	29
32	21 912	22 516	77 484	99 396	28
33	21 987	22 593	77 407	99 394	27
34	22 062	22 670	77 330	99 392	26
35	22 137	22 747	77 253	99 390	25
36	22 211	22 824	77 176	99 388	24
37	22 286	22 901	77 099	99 385	23
38	22 361	22 977	77 023	99 383	22
39	22 435	23 054	76 946	99 381	21
40	22 509	23 130	76 870	99 379	20
41	22 583	23 206	76 794	99 377	19
42	22 657	23 283	76 717	99 375	18
43	22 731	23 359	76 641	99 372	17
44	22 805	23 435	76 565	99 370	16
45	22 878	23 510	76 490	99 368	15
46	22 952	23 586	76 414	99 366	14
47	23 025	23 661	76 339	99 364	13
48	23 098	23 737	76 263	99 362	12
49	23 171	23 812	76 188	99 359	11
50	23 244	23 887	76 113	99 357	10
51	23 317	23 962	76 038	99 355	9
52	23 390	24 037	75 963	99 353	8
53	23 462	24 112	75 888	99 351	7
54	23 535	24 186	75 814	99 348	6
55	23 607	24 261	75 739	99 346	5
56	23 679	24 335	75 665	99 344	4
57	23 752	24 410	75 590	99 342	3
58	23 823	24 484	75 516	99 340	2
59	23 895	24 558	75 442	99 337	1
60	23 967	24 632	75 368	99 335	0
	9	9	10	9	
′	log cos	log cot	log tan	log sin	′

80°

10°

′	log sin	log tan	log cot	log cos	′
	9	9	10	9	
0	23 967	24 632	75 368	99 335	60
1	24 039	24 706	75 294	99 333	59
2	24 110	24 779	75 221	99 331	58
3	24 181	24 853	75 147	99 328	57
4	24 253	24 926	75 074	99 326	56
5	24 324	25 000	75 000	99 324	55
6	24 395	25 073	74 927	99 322	54
7	24 466	25 146	74 854	99 319	53
8	24 536	25 219	74 781	99 317	52
9	24 607	25 292	74 708	99 315	51
10	24 677	25 365	74 635	99 313	50
11	24 748	25 437	74 563	99 310	49
12	24 818	25 510	74 490	99 308	48
13	24 888	25 582	74 418	99 306	47
14	24 958	25 655	74 345	99 304	46
15	25 028	25 727	74 273	99 301	45
16	25 098	25 799	74 201	99 299	44
17	25 168	25 871	74 129	99 297	43
18	25 237	25 943	74 057	99 294	42
19	25 307	26 015	73 985	99 292	41
20	25 376	26 086	73 914	99 290	40
21	25 445	26 158	73 842	99 288	39
22	25 514	26 229	73 771	99 285	38
23	25 583	26 301	73 699	99 283	37
24	25 652	26 372	73 628	99 281	36
25	25 721	26 443	73 557	99 278	35
26	25 790	26 514	73 486	99 276	34
27	25 858	26 585	73 415	99 274	33
28	25 927	26 655	73 345	99 271	32
29	25 995	26 726	73 274	99 269	31
30	26 063	26 797	73 203	99 267	30
31	26 131	26 867	73 133	99 264	29
32	26 199	26 937	73 063	99 262	28
33	26 267	27 008	72 992	99 260	27
34	26 335	27 078	72 922	99 257	26
35	26 403	27 148	72 852	99 255	25
36	26 470	27 218	72 782	99 252	24
37	26 538	27 288	72 712	99 250	23
38	26 605	27 357	72 643	99 248	22
39	26 672	27 427	72 573	99 245	21
40	26 739	27 496	72 504	99 243	20
41	26 806	27 566	72 434	99 241	19
42	26 873	27 635	72 365	99 238	18
43	26 940	27 704	72 296	99 236	17
44	27 007	27 773	72 227	99 233	16
45	27 073	27 842	72 158	99 231	15
46	27 140	27 911	72 089	99 229	14
47	27 206	27 980	72 020	99 226	13
48	27 273	28 049	71 951	99 224	12
49	27 339	28 117	71 883	99 221	11
50	27 405	28 186	71 814	99 219	10
51	27 471	28 254	71 746	99 217	9
52	27 537	28 323	71 677	99 214	8
53	27 602	28 391	71 609	99 212	7
54	27 668	28 459	71 541	99 209	6
55	27 734	28 527	71 473	99 207	5
56	27 799	28 595	71 405	99 204	4
57	27 864	28 662	71 338	99 202	3
58	27 930	28 730	71 270	99 200	2
59	27 995	28 798	71 202	99 197	1
60	28 060	28 865	71 135	99 195	0
	9	9	10	9	
′	log cos	log cot	log tan	log sin	′

79°

11°

′	log sin −9	log tan −9	log cot +10	log cos −9	′
0	28 060	28 865	71 135	99 195	60
1	28 125	28 933	71 067	99 192	59
2	28 190	29 000	71 000	99 190	58
3	28 254	29 067	70 933	99 187	57
4	28 319	29 134	70 866	99 185	56
5	28 384	29 201	70 799	99 182	55
6	28 448	29 268	70 732	99 180	54
7	28 512	29 335	70 665	99 177	53
8	28 577	29 402	70 598	99 175	52
9	28 641	29 468	70 532	99 172	51
10	28 705	29 535	70 465	99 170	50
11	28 769	29 601	70 399	99 167	49
12	28 833	29 668	70 332	99 165	48
13	28 896	29 734	70 266	99 162	47
14	28 960	29 800	70 200	99 160	46
15	29 024	29 866	70 134	99 157	45
16	29 087	29 932	70 068	99 155	44
17	29 150	29 998	70 002	99 152	43
18	29 214	30 064	69 936	99 150	42
19	29 277	30 130	69 870	99 147	41
20	29 340	30 195	69 805	99 145	40
21	29 403	30 261	69 739	99 142	39
22	29 466	30 326	69 674	99 140	38
23	29 529	30 391	69 609	99 137	37
24	29 591	30 457	69 543	99 135	36
25	29 654	30 522	69 478	99 132	35
26	29 716	30 587	69 413	99 130	34
27	29 779	30 652	69 348	99 127	33
28	29 841	30 717	69 283	99 124	32
29	29 903	30 782	69 218	99 122	31
30	29 966	30 846	69 154	99 119	30
31	30 028	30 911	69 089	99 117	29
32	30 090	30 975	69 025	99 114	28
33	30 151	31 040	68 960	99 112	27
34	30 213	31 104	68 896	99 109	26
35	30 275	31 168	68 832	99 106	25
36	30 336	31 233	68 767	99 104	24
37	30 398	31 297	68 703	99 101	23
38	30 459	31 361	68 639	99 099	22
39	30 521	31 425	68 575	99 096	21
40	30 582	31 489	68 511	99 093	20
41	30 643	31 552	68 448	99 091	19
42	30 704	31 616	68 384	99 088	18
43	30 765	31 679	68 321	99 086	17
44	30 826	31 743	68 257	99 083	16
45	30 887	31 806	68 194	99 080	15
46	30 947	31 870	68 130	99 078	14
47	31 008	31 933	68 067	99 075	13
48	31 068	31 996	68 004	99 072	12
49	31 129	32 059	67 941	99 070	11
50	31 189	32 122	67 878	99 067	10
51	31 250	32 185	67 815	99 064	9
52	31 310	32 248	67 752	99 062	8
53	31 370	32 311	67 689	99 059	7
54	31 430	32 373	67 627	99 056	6
55	31 490	32 436	67 564	99 054	5
56	31 549	32 498	67 502	99 051	4
57	31 609	32 561	67 439	99 048	3
58	31 669	32 623	67 377	99 046	2
59	31 728	32 685	67 315	99 043	1
60	31 788	32 747	67 253	99 040	0
′	−9 log cos	−9 log cot	−10 log tan	−9 log sin	′

78°

12°

′	log sin −9	log tan −9	log cot −10	log cos −9	′
0	31 788	32 747	67 253	99 040	60
1	31 847	32 810	67 190	99 038	59
2	31 907	32 872	67 128	99 035	58
3	31 966	32 933	67 067	99 032	57
4	32 025	32 995	67 005	99 030	56
5	32 084	33 057	66 943	99 027	55
6	32 143	33 119	66 881	99 024	54
7	32 202	33 180	66 820	99 022	53
8	32 261	33 242	66 758	99 019	52
9	32 319	33 303	66 697	99 016	51
10	32 378	33 365	66 635	99 013	50
11	32 437	33 426	66 574	99 011	49
12	32 495	33 487	66 513	99 008	48
13	32 553	33 548	66 452	99 005	47
14	32 612	33 609	66 391	99 002	46
15	32 670	33 670	66 330	99 000	45
16	32 728	33 731	66 269	98 997	44
17	32 786	33 792	66 208	98 994	43
18	32 844	33 853	66 147	98 991	42
19	32 902	33 913	66 087	98 989	41
20	32 960	33 974	66 026	98 986	40
21	33 018	34 034	65 966	98 983	39
22	33 075	34 095	65 905	98 980	38
23	33 133	34 155	65 845	98 978	37
24	33 190	34 215	65 785	98 975	36
25	33 248	34 276	65 724	98 972	35
26	33 305	34 336	65 664	98 969	34
27	33 362	34 396	65 604	98 967	33
28	33 420	34 456	65 544	98 964	32
29	33 477	34 516	65 484	98 961	31
30	33 534	34 576	65 424	98 958	30
31	33 591	34 635	65 365	98 955	29
32	33 647	34 695	65 305	98 953	28
33	33 704	34 755	65 245	98 950	27
34	33 761	34 814	65 186	98 947	26
35	33 818	34 874	65 126	98 944	25
36	33 874	34 933	65 067	98 941	24
37	33 931	34 992	65 008	98 938	23
38	33 987	35 051	64 949	98 936	22
39	34 043	35 111	64 889	98 933	21
40	34 100	35 170	64 830	98 930	20
41	34 156	35 229	64 771	98 927	19
42	34 212	35 288	64 712	98 924	18
43	34 268	35 347	64 653	98 921	17
44	34 324	35 405	64 595	98 919	16
45	34 380	35 464	64 536	98 916	15
46	34 436	35 523	64 477	98 913	14
47	34 491	35 581	64 419	98 910	13
48	34 547	35 640	64 360	98 907	12
49	34 602	35 698	64 302	98 904	11
50	34 658	35 757	64 243	98 901	10
51	34 713	35 815	64 185	98 898	9
52	34 769	35 873	64 127	98 896	8
53	34 824	35 931	64 069	98 893	7
54	34 879	35 989	64 011	98 890	6
55	34 934	36 047	63 953	98 887	5
56	34 989	36 105	63 895	98 884	4
57	35 044	36 163	63 837	98 881	3
58	35 099	36 221	63 779	98 878	2
59	35 154	36 279	63 721	98 875	1
60	35 209	36 336	63 664	98 872	0
′	−9 log cos	−9 log cot	−10 log tan	−9 log sin	′

77°

13°

′	log sin	log tan	log cot	log cos	′
	9	9	10	9	
0	35 209	36 336	63 664	98 872	60
1	35 263	36 394	63 606	98 869	59
2	35 318	36 452	63 548	98 867	58
3	35 373	36 509	63 491	98 864	57
4	35 427	36 566	63 434	98 861	56
5	35 481	36 624	63 376	98 858	55
6	35 536	36 681	63 319	98 855	54
7	35 590	36 738	63 262	98 852	53
8	35 644	36 795	63 205	98 849	52
9	35 698	36 852	63 148	98 846	51
10	35 752	36 909	63 091	98 843	50
11	35 806	36 966	63 034	98 840	49
12	35 860	37 023	62 977	98 837	48
13	35 914	37 080	62 920	98 834	47
14	35 968	37 137	62 863	98 831	46
15	36 022	37 193	62 807	98 828	45
16	36 075	37 250	62 750	98 825	44
17	36 129	37 306	62 694	98 822	43
18	36 182	37 363	62 637	98 819	42
19	36 236	37 419	62 581	98 816	41
20	36 289	37 476	62 524	98 813	40
21	36 342	37 532	62 468	98 810	39
22	36 395	37 588	62 412	98 807	38
23	36 449	37 644	62 356	98 804	37
24	36 502	37 700	62 300	98 801	36
25	36 555	37 756	62 244	98 798	35
26	36 608	37 812	62 188	98 795	34
27	36 660	37 868	62 132	98 792	33
28	36 713	37 924	62 076	98 789	32
29	36 766	37 980	62 020	98 786	31
30	36 819	38 035	61 965	98 783	30
31	36 871	38 091	61 909	98 780	29
32	36 924	38 147	61 853	98 777	28
33	36 976	38 202	61 798	98 774	27
34	37 028	38 257	61 743	98 771	26
35	37 081	38 313	61 687	98 768	25
36	37 133	38 368	61 632	98 765	24
37	37 185	38 423	61 577	98 762	23
38	37 237	38 479	61 521	98 759	22
39	37 289	38 534	61 466	98 756	21
40	37 341	38 589	61 411	98 753	20
41	37 393	38 644	61 356	98 750	19
42	37 445	38 699	61 301	98 746	18
43	37 497	38 754	61 246	98 743	17
44	37 549	38 808	61 192	98 740	16
45	37 600	38 863	61 137	98 737	15
46	37 652	38 918	61 082	98 734	14
47	37 703	38 972	61 028	98 731	13
48	37 755	39 027	60 973	98 728	12
49	37 806	39 082	60 918	98 725	11
50	37 858	39 136	60 864	98 722	10
51	37 909	39 190	60 810	98 719	9
52	37 960	39 245	60 755	98 715	8
53	38 011	39 299	60 701	98 712	7
54	38 062	39 353	60 647	98 709	6
55	38 113	39 407	60 593	98 706	5
56	38 164	39 461	60 539	98 703	4
57	38 215	39 515	60 485	98 700	3
58	38 266	39 569	60 431	98 697	2
59	38 317	39 623	60 377	98 694	1
60	38 368	39 677	60 323	98 690	0
	9	9	10	9	
′	log cos	log cot	log tan	log sin	′

76°

14°

′	log sin	log tan	log cot	log cos	′
	9	9	10	9	
0	38 368	39 677	60 323	98 690	60
1	38 418	39 731	60 269	98 687	59
2	38 469	39 785	60 215	98 684	58
3	38 519	39 838	60 162	98 681	57
4	38 570	39 892	60 108	98 678	56
5	38 620	39 945	60 055	98 675	55
6	38 670	39 999	60 001	98 671	54
7	38 721	40 052	59 948	98 668	53
8	38 771	40 106	59 894	98 665	52
9	38 821	40 159	59 841	98 662	51
10	38 871	40 212	59 788	98 659	50
11	38 921	40 266	59 734	98 656	49
12	38 971	40 319	59 681	98 652	48
13	39 021	40 372	59 628	98 649	47
14	39 071	40 425	59 575	98 646	46
15	39 121	40 478	59 522	98 643	45
16	39 170	40 531	59 469	98 640	44
17	39 220	40 584	59 416	98 636	43
18	39 270	40 636	59 364	98 633	42
19	39 319	40 689	59 311	98 630	41
20	39 369	40 742	59 258	98 627	40
21	39 418	40 795	59 205	98 623	39
22	39 467	40 847	59 153	98 620	38
23	39 517	40 900	59 100	98 617	37
24	39 566	40 952	59 048	98 614	36
25	39 615	41 005	58 995	98 610	35
26	39 664	41 057	58 943	98 607	34
27	39 713	41 109	58 891	98 604	33
28	39 762	41 161	58 839	98 601	32
29	39 811	41 214	58 786	98 597	31
30	39 860	41 266	58 734	98 594	30
31	39 909	41 318	58 682	98 591	29
32	39 958	41 370	58 630	98 588	28
33	40 006	41 422	58 578	98 584	27
34	40 055	41 474	58 526	98 581	26
35	40 103	41 526	58 474	98 578	25
36	40 152	41 578	58 422	98 574	24
37	40 200	41 629	58 371	98 571	23
38	40 249	41 681	58 319	98 568	22
39	40 297	41 733	58 267	98 565	21
40	40 346	41 784	58 216	98 561	20
41	40 394	41 836	58 164	98 558	19
42	40 442	41 887	58 113	98 555	18
43	40 490	41 939	58 061	98 551	17
44	40 538	41 990	58 010	98 548	16
45	40 586	42 041	57 959	98 545	15
46	40 634	42 093	57 907	98 541	14
47	40 682	42 144	57 856	98 538	13
48	40 730	42 195	57 805	98 535	12
49	40 778	42 246	57 754	98 531	11
50	40 825	42 297	57 703	98 528	10
51	40 873	42 348	57 652	98 525	9
52	40 921	42 399	57 601	98 521	8
53	40 968	42 450	57 550	98 518	7
54	41 016	42 501	57 499	98 515	6
55	41 063	42 552	57 448	98 511	5
56	41 111	42 603	57 397	98 508	4
57	41 158	42 653	57 347	98 505	3
58	41 205	42 704	57 296	98 501	2
59	41 252	42 755	57 245	98 498	1
60	41 300	42 805	57 195	98 494	0
	9	9	10	9	
′	log cos	log cot	log tan	log sin	′

75°

15°

′	log sin	log tan	log cot	log cos	′
	9	9	10	9	
0	41 300	42 805	57 195	98 494	60
1	41 347	42 856	57 144	98 491	59
2	41 394	42 906	57 094	98 488	58
3	41 441	42 957	57 043	98 484	57
4	41 488	43 007	56 993	98 481	56
5	41 535	43 057	56 943	98 477	55
6	41 582	43 108	56 892	98 474	54
7	41 628	43 158	56 842	98 471	53
8	41 675	43 208	56 792	98 467	52
9	41 722	43 258	56 742	98 464	51
10	41 768	43 308	56 692	98 460	50
11	41 815	43 358	56 642	98 457	49
12	41 861	43 408	56 592	98 453	48
13	41 908	43 458	56 542	98 450	47
14	41 954	43 508	56 492	98 447	46
15	42 001	43 558	56 442	98 443	45
16	42 047	43 607	56 393	98 440	44
17	42 093	43 657	56 343	98 436	43
18	42 140	43 707	56 293	98 433	42
19	42 186	43 756	56 244	98 429	41
20	42 232	43 806	56 194	98 426	40
21	42 278	43 855	56 145	98 422	39
22	42 324	43 905	56 095	98 419	38
23	42 370	43 954	56 046	98 415	37
24	42 416	44 004	55 996	98 412	36
25	42 461	44 053	55 947	98 409	35
26	42 507	44 102	55 898	98 405	34
27	42 553	44 151	55 849	98 402	33
28	42 599	44 201	55 799	98 398	32
29	42 644	44 250	55 750	98 395	31
30	42 690	44 299	55 701	98 391	30
31	42 735	44 348	55 652	98 388	29
32	42 781	44 397	55 603	98 384	28
33	42 826	44 446	55 554	98 381	27
34	42 872	44 495	55 505	98 377	26
35	42 917	44 544	55 456	98 373	25
36	42 962	44 592	55 408	98 370	24
37	43 008	44 641	55 359	98 366	23
38	43 053	44 690	55 310	98 363	22
39	43 098	44 738	55 262	98 359	21
40	43 143	44 787	55 213	98 356	20
41	43 188	44 836	55 164	98 352	19
42	43 233	44 884	55 116	98 349	18
43	43 278	44 933	55 067	98 345	17
44	43 323	44 981	55 019	98 342	16
45	43 367	45 029	54 971	98 338	15
46	43 412	45 078	54 922	98 334	14
47	43 457	45 126	54 874	98 331	13
48	43 502	45 174	54 826	98 327	12
49	43 546	45 222	54 778	98 324	11
50	43 591	45 271	54 729	98 320	10
51	43 635	45 319	54 681	98 317	9
52	43 680	45 367	54 633	98 313	8
53	43 724	45 415	54 585	98 309	7
54	43 769	45 463	54 537	98 306	6
55	43 813	45 511	54 489	98 302	5
56	43 857	45 559	54 441	98 299	4
57	43 901	45 606	54 394	98 295	3
58	43 946	45 654	54 346	98 291	2
59	43 990	45 702	54 298	98 288	1
60	44 034	45 750	54 250	98 284	0
	9	9	10	9	
′	log cos	log cot	log tan	log sin	′

74°

16°

′	log sin	log tan	log cot	log cos	′
	9	9	10	9	
0	44 034	45 750	54 250	98 284	60
1	44 078	45 797	54 203	98 281	59
2	44 122	45 845	54 155	98 277	58
3	44 166	45 892	54 108	98 273	57
4	44 210	45 940	54 060	98 270	56
5	44 253	45 987	54 013	98 266	55
6	44 297	46 035	53 965	98 262	54
7	44 341	46 082	53 918	98 259	53
8	44 385	46 130	53 870	98 255	52
9	44 428	46 177	53 823	98 251	51
10	44 472	46 224	53 776	98 248	50
11	44 516	46 271	53 729	98 244	49
12	44 559	46 319	53 681	98 240	48
13	44 602	46 366	53 634	98 237	47
14	44 646	46 413	53 587	98 233	46
15	44 689	46 460	53 540	98 229	45
16	44 733	46 507	53 493	98 226	44
17	44 776	46 554	53 446	98 222	43
18	44 819	46 601	53 399	98 218	42
19	44 862	46 648	53 352	98 215	41
20	44 905	46 694	53 306	98 211	40
21	44 948	46 741	53 259	98 207	39
22	44 992	46 788	53 212	98 204	38
23	45 035	46 835	53 165	98 200	37
24	45 077	46 881	53 119	98 196	36
25	45 120	46 928	53 072	98 192	35
26	45 163	46 975	53 025	98 189	34
27	45 206	47 021	52 979	98 185	33
28	45 249	47 068	52 932	98 181	32
29	45 292	47 114	52 886	98 177	31
30	45 334	47 160	52 840	98 174	30
31	45 377	47 207	52 793	98 170	29
32	45 419	47 253	52 747	98 166	28
33	45 462	47 299	52 701	98 162	27
34	45 504	47 346	52 654	98 159	26
35	45 547	47 392	52 608	98 155	25
36	45 589	47 438	52 562	98 151	24
37	45 632	47 484	52 516	98 147	23
38	45 674	47 530	52 470	98 144	22
39	45 716	47 576	52 424	98 140	21
40	45 758	47 622	52 378	98 136	20
41	45 801	47 668	52 332	98 132	19
42	45 843	47 714	52 286	98 129	18
43	45 885	47 760	52 240	98 125	17
44	45 927	47 806	52 194	98 121	16
45	45 969	47 852	52 148	98 117	15
46	46 011	47 897	52 103	98 113	14
47	46 053	47 943	52 057	98 110	13
48	46 095	47 989	52 011	98 106	12
49	46 136	48 035	51 965	98 102	11
50	46 178	48 080	51 920	98 098	10
51	46 220	48 126	51 874	98 094	9
52	46 262	48 171	51 829	98 090	8
53	46 303	48 217	51 783	98 087	7
54	46 345	48 262	51 738	98 083	6
55	46 386	48 307	51 693	98 079	5
56	46 428	48 353	51 647	98 075	4
57	46 469	48 398	51 602	98 071	3
58	46 511	48 443	51 557	98 067	2
59	46 552	48 489	51 511	98 063	1
60	46 594	48 534	51 466	98 060	0
	9	9	10	9	
′	log cos	log cot	log tan	log sin	′

73°

17°

′	log sin	log tan	log cot	log cos	′
	9	9	10	9	
0	46 594	48 534	51 466	98 060	60
1	46 635	48 579	51 421	98 056	59
2	46 676	48 624	51 376	98 052	58
3	46 717	48 669	51 331	98 048	57
4	46 758	48 714	51 286	98 044	56
5	46 800	48 759	51 241	98 040	55
6	46 841	48 804	51 196	98 036	54
7	46 882	48 849	51 151	98 032	53
8	46 923	48 894	51 106	98 029	52
9	46 964	48 939	51 061	98 025	51
10	47 005	48 984	51 016	98 021	50
11	47 045	49 029	50 971	98 017	49
12	47 086	49 073	50 927	98 013	48
13	47 127	49 118	50 882	98 009	47
14	47 168	49 163	50 837	98 005	46
15	47 209	49 207	50 793	98 001	45
16	47 249	49 252	50 748	97 997	44
17	47 290	49 296	50 704	97 993	43
18	47 330	49 341	50 659	97 989	42
19	47 371	49 385	50 615	97 986	41
20	47 411	49 430	50 570	97 982	40
21	47 452	49 474	50 526	97 978	39
22	47 492	49 519	50 481	97 974	38
23	47 533	49 563	50 437	97 970	37
24	47 573	49 607	50 393	97 966	36
25	47 613	49 652	50 348	97 962	35
26	47 654	49 696	50 304	97 958	34
27	47 694	49 740	50 260	97 954	33
28	47 734	49 784	50 216	97 950	32
29	47 774	49 828	50 172	97 946	31
30	47 814	49 872	50 128	97 942	30
31	47 854	49 916	50 084	97 938	29
32	47 894	49 960	50 040	97 934	28
33	47 934	50 004	49 996	97 930	27
34	47 974	50 048	49 952	97 926	26
35	48 014	50 092	49 908	97 922	25
36	48 054	50 136	49 864	97 918	24
37	48 094	50 180	49 820	97 914	23
38	48 133	50 223	49 777	97 910	22
39	48 173	50 267	49 733	97 906	21
40	48 213	50 311	49 689	97 902	20
41	48 252	50 355	49 645	97 898	19
42	48 292	50 398	49 602	97 894	18
43	48 332	50 442	49 558	97 890	17
44	48 371	50 485	49 515	97 886	16
45	48 411	50 529	49 471	97 882	15
46	48 450	50 572	49 428	97 878	14
47	48 490	50 616	49 384	97 874	13
48	48 529	50 659	49 341	97 870	12
49	48 568	50 703	49 297	97 866	11
50	48 607	50 746	49 254	97 861	10
51	48 647	50 789	49 211	97 857	9
52	48 686	50 833	49 167	97 853	8
53	48 725	50 876	49 124	97 849	7
54	48 764	50 919	49 081	97 845	6
55	48 803	50 962	49 038	97 841	5
56	48 842	51 005	48 995	97 837	4
57	48 881	51 048	48 952	97 833	3
58	48 920	51 092	48 908	97 829	2
59	48 959	51 135	48 865	97 825	1
60	48 998	51 178	48 822	97 821	0
	9	9	10	9	
′	log cos	log cot	log tan	log sin	′

72°

18°

′	log sin	log tan	log cot	log cos	′
	9	9	10	9	
0	48 998	51 178	48 822	97 821	60
1	49 037	51 221	48 779	97 817	59
2	49 076	51 264	48 736	97 812	58
3	49 115	51 306	48 694	97 808	57
4	49 153	51 349	48 651	97 804	56
5	49 192	51 392	48 608	97 800	55
6	49 231	51 435	48 565	97 796	54
7	49 269	51 478	48 522	97 792	53
8	49 308	51 520	48 480	97 788	52
9	49 347	51 563	48 437	97 784	51
10	49 385	51 606	48 394	97 779	50
11	49 424	51 648	48 352	97 775	49
12	49 462	51 691	48 309	97 771	48
13	49 500	51 734	48 266	97 767	47
14	49 539	51 776	48 224	97 763	46
15	49 577	51 819	48 181	97 759	45
16	49 615	51 861	48 139	97 754	44
17	49 654	51 903	48 097	97 750	43
18	49 692	51 946	48 054	97 746	42
19	49 730	51 988	48 012	97 742	41
20	49 768	52 031	47 969	97 738	40
21	49 806	52 073	47 927	97 734	39
22	49 844	52 115	47 885	97 729	38
23	49 882	52 157	47 843	97 725	37
24	49 920	52 200	47 800	97 721	36
25	49 958	52 242	47 758	97 717	35
26	49 996	52 284	47 716	97 713	34
27	50 034	52 326	47 674	97 708	33
28	50 072	52 368	47 632	97 704	32
29	50 110	52 410	47 590	97 700	31
30	50 148	52 452	47 548	97 696	30
31	50 185	52 494	47 506	97 691	29
32	50 223	52 536	47 464	97 687	28
33	50 261	52 578	47 422	97 683	27
34	50 298	52 620	47 380	97 679	26
35	50 336	52 661	47 339	97 674	25
36	50 374	52 703	47 297	97 670	24
37	50 411	52 745	47 255	97 666	23
38	50 449	52 787	47 213	97 662	22
39	50 486	52 829	47 171	97 657	21
40	50 523	52 870	47 130	97 653	20
41	50 561	52 912	47 088	97 649	19
42	50 598	52 953	47 047	97 645	18
43	50 635	52 995	47 005	97 640	17
44	50 673	53 037	46 963	97 636	16
45	50 710	53 078	46 922	97 632	15
46	50 747	53 120	46 880	97 628	14
47	50 784	53 161	46 839	97 623	13
48	50 821	53 202	46 798	97 619	12
49	50 858	53 244	46 756	97 615	11
50	50 896	53 285	46 715	97 610	10
51	50 933	53 327	46 673	97 606	9
52	50 970	53 368	46 632	97 602	8
53	51 007	53 409	46 591	97 597	7
54	51 043	53 450	46 550	97 593	6
55	51 080	53 492	46 508	97 589	5
56	51 117	53 533	46 467	97 584	4
57	51 154	53 574	46 426	97 580	3
58	51 191	53 615	46 385	97 576	2
59	51 227	53 656	46 344	97 571	1
60	51 264	53 697	46 303	97 567	0
	9	9	10	9	
′	log cos	log cot	log tan	log sin	′

71°

19°

′	log sin	log tan	log cot	log cos	′
	9	9	10	9	
0	51 264	53 697	46 303	97 567	60
1	51 301	53 738	46 262	97 563	59
2	51 338	53 779	46 221	97 558	58
3	51 374	53 820	46 180	97 554	57
4	51 411	53 861	46 139	97 555	56
5	51 447	53 902	46 098	97 545	55
6	51 484	53 943	46 057	97 541	54
7	51 520	53 984	46 016	97 536	53
8	51 557	54 025	45 975	97 532	52
9	51 593	54 065	45 935	97 528	51
10	51 629	54 106	45 894	97 523	50
11	51 666	54 147	45 853	97 519	49
12	51 702	54 187	45 813	97 515	48
13	51 738	54 228	45 772	97 510	47
14	51 774	54 269	45 731	97 506	46
15	51 811	54 309	45 691	97 501	45
16	51 847	54 350	45 650	97 497	44
17	51 883	54 390	45 610	97 492	43
18	51 919	54 431	45 569	97 488	42
19	51 955	54 471	45 529	97 484	41
20	51 991	54 512	45 488	97 479	40
21	52 027	54 552	45 448	97 475	39
22	52 063	54 593	45 407	97 470	38
23	52 099	54 633	45 367	97 466	37
24	52 135	54 673	45 327	97 461	36
25	52 171	54 714	45 286	97 457	35
26	52 207	54 754	45 246	97 453	34
27	52 242	54 794	45 206	97 448	33
28	52 278	54 835	45 165	97 444	32
29	52 314	54 875	45 125	97 439	31
30	52 350	54 915	45 085	97 435	30
31	52 385	54 955	45 045	97 430	29
32	52 421	54 995	45 005	97 426	28
33	52 456	55 035	44 965	97 421	27
34	52 492	55 075	44 925	97 417	26
35	52 527	55 115	44 885	97 412	25
36	52 563	55 155	44 845	97 408	24
37	52 598	55 195	44 805	97 403	23
38	52 634	55 235	44 765	97 399	22
39	52 669	55 275	44 725	97 394	21
40	52 705	55 315	44 685	97 390	20
41	52 740	55 355	44 645	97 385	19
42	52 775	55 395	44 605	97 381	18
43	52 811	55 434	44 566	97 376	17
44	52 846	55 474	44 526	97 372	16
45	52 881	55 514	44 486	97 367	15
46	52 916	55 554	44 446	97 363	14
47	52 951	55 593	44 407	97 358	13
48	52 986	55 633	44 367	97 353	12
49	53 021	55 673	44 327	97 349	11
50	53 056	55 712	44 288	97 344	10
51	53 092	55 752	44 248	97 340	9
52	53 126	55 791	44 209	97 335	8
53	53 161	55 831	44 169	97 331	7
54	53 196	55 870	44 130	97 326	6
55	53 231	55 910	44 090	97 322	5
56	53 266	55 949	44 051	97 317	4
57	53 301	55 989	44 011	97 312	3
58	53 336	56 028	43 972	97 308	2
59	53 370	56 067	43 933	97 303	1
60	53 405	56 107	43 893	97 299	0
	9	9	10	9	
′	log cos	log cot	log tan	log sin	′

20°

′	log sin	log tan	log cot	log cos	′
	9	9	10	9	
0	53 405	56 107	43 893	97 299	60
1	53 440	56 146	43 854	97 294	59
2	53 475	56 185	43 815	97 289	58
3	53 509	56 224	43 776	97 285	57
4	53 544	56 264	43 736	97 280	56
5	53 578	56 303	43 697	97 276	55
6	53 613	56 342	43 658	97 271	54
7	53 647	56 381	43 619	97 266	53
8	53 682	56 420	43 580	97 262	52
9	53 716	56 459	43 541	97 257	51
10	53 751	56 498	43 502	97 252	50
11	53 785	56 537	43 463	97 248	49
12	53 819	56 576	43 424	97 243	48
13	53 854	56 615	43 385	97 238	47
14	53 888	56 654	43 346	97 234	46
15	53 922	56 693	43 307	97 229	45
16	53 957	56 732	43 268	97 224	44
17	53 991	56 771	43 229	97 220	43
18	54 025	56 810	43 190	97 215	42
19	54 059	56 849	43 151	97 210	41
20	54 093	56 887	43 113	97 206	40
21	54 127	56 926	43 074	97 201	39
22	54 161	56 965	43 035	97 196	38
23	54 195	57 004	42 996	97 192	37
24	54 229	57 042	42 958	97 187	36
25	54 263	57 081	42 919	97 182	35
26	54 297	57 120	42 880	97 178	34
27	54 331	57 158	42 842	97 173	33
28	54 365	57 197	42 803	97 168	32
29	54 399	57 235	42 765	97 163	31
30	54 433	57 274	42 726	97 159	30
31	54 466	57 312	42 688	97 154	29
32	54 500	57 351	42 649	97 149	28
33	54 534	57 389	42 611	97 145	27
34	54 567	57 428	42 572	97 140	26
35	54 601	57 466	42 534	97 135	25
36	54 635	57 504	42 496	97 130	24
37	54 668	57 543	42 457	97 126	23
38	54 702	57 581	42 419	97 121	22
39	54 735	57 619	42 381	97 116	21
40	54 769	57 658	42 342	97 111	20
41	54 802	57 696	42 304	97 107	19
42	54 836	57 734	42 266	97 102	18
43	54 869	57 772	42 228	97 097	17
44	54 903	57 810	42 190	97 092	16
45	54 936	57 849	42 151	97 087	15
46	54 969	57 887	42 113	97 083	14
47	55 003	57 925	42 075	97 078	13
48	55 036	57 963	42 037	97 073	12
49	55 069	58 001	41 999	97 068	11
50	55 102	58 039	41 961	97 063	10
51	55 136	58 077	41 923	97 059	9
52	55 169	58 115	41 885	97 054	8
53	55 202	58 153	41 847	97 049	7
54	55 235	58 191	41 809	97 044	6
55	55 268	58 229	41 771	97 039	5
56	55 301	58 267	41 733	97 035	4
57	55 334	58 304	41 696	97 030	3
58	55 367	58 342	41 658	97 025	2
59	55 400	58 380	41 620	97 020	1
60	55 433	58 418	41 582	97 015	0
	9	9	10	9	
′	log cos	log cot	log tan	log sin	′

21°

′	log sin	log tan	log cot	log cos	′
	9	9	10	9	
0	55 433	58 418	41 582	97 015	60
1	55 466	58 455	41 545	97 010	59
2	55 499	58 493	41 507	97 005	58
3	55 532	58 531	41 469	97 001	57
4	55 564	58 569	41 431	96 996	56
5	55 597	58 606	41 394	96 991	55
6	55 630	58 644	41 356	96 986	54
7	55 663	58 681	41 319	96 981	53
8	55 695	58 719	41 281	96 976	52
9	55 728	58 757	41 243	96 971	51
10	55 761	58 794	41 206	96 966	50
11	55 793	58 832	41 168	96 962	49
12	55 826	58 869	41 131	96 957	48
13	55 858	58 907	41 093	96 952	47
14	55 891	58 944	41 056	96 947	46
15	55 923	58 981	41 019	96 942	45
16	55 956	59 019	40 981	96 937	44
17	55 988	59 056	40 944	96 932	43
18	56 021	59 094	40 906	96 927	42
19	56 053	59 131	40 869	96 922	41
20	56 085	59 168	40 832	96 917	40
21	56 118	59 205	40 795	96 912	39
22	56 150	59 243	40 757	96 907	38
23	56 182	59 280	40 720	96 903	37
24	56 215	59 317	40 683	96 898	36
25	56 247	59 354	40 646	96 893	35
26	56 279	59 391	40 609	96 888	34
27	56 311	59 429	40 571	96 883	33
28	56 343	59 466	40 534	96 878	32
29	56 375	59 503	40 497	96 873	31
30	56 408	59 540	40 460	96 868	30
31	56 440	59 577	40 423	96 863	29
32	56 472	59 614	40 386	96 858	28
33	56 504	59 651	40 349	96 853	27
34	56 536	59 688	40 312	96 848	26
35	56 568	59 725	40 275	96 843	25
36	56 599	59 762	40 238	96 838	24
37	56 631	59 799	40 201	96 833	23
38	56 663	59 835	40 165	96 828	22
39	56 695	59 872	40 128	96 823	21
40	56 727	59 909	40 091	96 818	20
41	56 759	59 946	40 054	96 813	19
42	56 790	59 983	40 017	96 808	18
43	56 822	60 019	39 981	96 803	17
44	56 854	60 056	39 944	96 798	16
45	56 886	60 093	39 907	96 793	15
46	56 917	60 130	39 870	96 788	14
47	56 949	60 166	39 834	96 783	13
48	56 980	60 203	39 797	96 778	12
49	57 012	60 240	39 760	96 772	11
50	57 044	60 276	39 724	96 767	10
51	57 075	60 313	39 687	96 762	9
52	57 107	60 349	39 651	96 757	8
53	57 138	60 386	39 614	96 752	7
54	57 169	60 422	39 578	96 747	6
55	57 201	60 459	39 541	96 742	5
56	57 232	60 495	39 505	96 737	4
57	57 264	60 532	39 468	96 732	3
58	57 295	60 568	39 432	96 727	2
59	57 326	60 605	39 395	96 722	1
60	57 358	60 641	39 359	96 717	0
	9	9	10	9	
′	log cos	log cot	log tan	log sin	′

22°

′	log sin	log tan	log cot	log cos	′
	9	9	10	9	
0	57 358	60 641	39 359	96 717	60
1	57 389	60 677	39 323	96 711	59
2	57 420	60 714	39 286	96 706	58
3	57 451	60 750	39 250	96 701	57
4	57 482	60 786	39 214	96 696	56
5	57 514	60 823	39 177	96 691	55
6	57 545	60 859	39 141	96 686	54
7	57 576	60 895	39 105	96 681	53
8	57 607	60 931	39 069	96 676	52
9	57 638	60 967	39 033	96 670	51
10	57 669	61 004	38 996	96 665	50
11	57 700	61 040	38 960	96 660	49
12	57 731	61 076	38 924	96 655	48
13	57 762	61 112	38 888	96 650	47
14	57 793	61 148	38 852	96 645	46
15	57 824	61 184	38 816	96 640	45
16	57 855	61 220	38 780	96 634	44
17	57 885	61 256	38 744	96 629	43
18	57 916	61 292	38 708	96 624	42
19	57 947	61 328	38 672	96 619	41
20	57 978	61 364	38 636	96 614	40
21	58 008	61 400	38 600	96 608	39
22	58 039	61 436	38 564	96 603	38
23	58 070	61 472	38 528	96 598	37
24	58 101	61 508	38 492	96 593	36
25	58 131	61 544	38 456	96 588	35
26	58 162	61 579	38 421	96 582	34
27	58 192	61 615	38 385	96 577	33
28	58 223	61 651	38 349	96 572	32
29	58 253	61 687	38 313	96 567	31
30	58 284	61 722	38 278	96 562	30
31	58 314	61 758	38 242	96 556	29
32	58 345	61 794	38 206	96 551	28
33	58 375	61 830	38 170	96 546	27
34	58 406	61 865	38 135	96 541	26
35	58 436	61 901	38 099	96 535	25
36	58 467	61 936	38 064	96 530	24
37	58 497	61 972	38 028	96 525	23
38	58 527	62 008	37 992	96 520	22
39	58 557	62 043	37 957	96 514	21
40	58 588	62 079	37 921	96 509	20
41	58 618	62 114	37 886	96 504	19
42	58 648	62 150	37 850	96 498	18
43	58 678	62 185	37 815	96 493	17
44	58 709	62 221	37 779	96 488	16
45	58 739	62 256	37 744	96 483	15
46	58 769	62 292	37 708	96 477	14
47	58 799	62 327	37 673	96 472	13
48	58 829	62 362	37 638	96 467	12
49	58 859	62 398	37 602	96 461	11
50	58 889	62 433	37 567	96 456	10
51	58 919	62 468	37 532	96 451	9
52	58 949	62 504	37 496	96 445	8
53	58 979	62 539	37 461	96 440	7
54	59 009	62 574	37 426	96 435	6
55	59 039	62 609	37 391	96 429	5
56	59 069	62 645	37 355	96 424	4
57	59 098	62 680	37 320	96 419	3
58	59 128	62 715	37 285	96 413	2
59	59 158	62 750	37 250	96 408	1
60	59 188	62 785	37 215	96 403	0
	9	9	10	9	
′	log cos	log cot	log tan	log sin	′

68° 67°

23°

′	log sin	log tan	log cot	log cos	′
	9	9	10	9	
0	59 188	62 785	37 215	96 403	60
1	59 218	62 820	37 180	96 397	59
2	59 247	62 855	37 145	96 392	58
3	59 277	62 890	37 110	96 387	57
4	59 307	62 926	37 074	96 381	56
5	59 336	62 961	37 039	96 376	55
6	59 366	62 996	37 004	96 370	54
7	59 396	63 031	36 969	96 365	53
8	59 425	63 066	36 934	96 360	52
9	59 455	63 101	36 899	96 354	51
10	59 484	63 135	36 865	96 349	50
11	59 514	63 170	36 830	96 343	49
12	59 543	63 205	36 795	96 338	48
13	59 573	63 240	36 760	96 333	47
14	59 602	63 275	36 725	96 327	46
15	59 632	63 310	36 690	96 322	45
16	59 661	63 345	36 655	96 316	44
17	59 690	63 379	36 621	96 311	43
18	59 720	63 414	36 586	96 305	42
19	59 749	63 449	36 551	96 300	41
20	59 778	63 484	36 516	96 294	40
21	59 808	63 519	36 481	96 289	39
22	59 837	63 553	36 447	96 284	38
23	59 866	63 588	36 412	96 278	37
24	59 895	63 623	36 377	96 273	36
25	59 924	63 657	36 343	96 267	35
26	59 954	63 692	36 308	96 262	34
27	59 983	63 726	36 274	96 256	33
28	60 012	63 761	36 239	96 251	32
29	60 041	63 796	36 204	96 245	31
30	60 070	63 830	36 170	96 240	30
31	60 099	63 865	36 135	96 234	29
32	60 128	63 899	36 101	96 229	28
33	60 157	63 934	36 066	96 223	27
34	60 186	63 968	36 032	96 218	26
35	60 215	64 003	35 997	96 212	25
36	60 244	64 037	35 963	96 207	24
37	60 273	64 072	35 928	96 201	23
38	60 302	64 106	35 894	96 196	22
39	60 331	64 140	35 860	96 190	21
40	60 359	64 175	35 825	96 185	20
41	60 388	64 209	35 791	96 179	19
42	60 417	64 243	35 757	96 174	18
43	60 446	64 278	35 722	96 168	17
44	60 474	64 312	35 688	96 162	16
45	60 503	64 346	35 654	96 157	15
46	60 532	64 381	35 619	96 151	14
47	60 561	64 415	35 585	96 146	13
48	60 589	64 449	35 551	96 140	12
49	60 618	64 483	35 517	96 135	11
50	60 646	64 517	35 483	96 129	10
51	60 675	64 552	35 448	96 123	9
52	60 704	64 586	35 414	96 118	8
53	60 732	64 620	35 380	96 112	7
54	60 761	64 654	35 346	96 107	6
55	60 789	64 688	35 312	96 101	5
56	60 818	64 722	35 278	96 095	4
57	60 846	64 756	35 244	96 090	3
58	60 875	64 790	35 210	96 084	2
59	60 903	64 824	35 176	96 079	1
60	60 931	64 858	35 142	96 073	0
	9	9	10	9	
′	log cos	log cot	log tan	log sin	′

66°

24°

′	log sin	log tan	log cot	log cos	′
	9	9	10	9	
0	60 931	64 858	35 142	96 073	60
1	60 960	64 892	35 108	96 067	59
2	60 988	64 926	35 074	96 062	58
3	61 016	64 960	35 040	96 056	57
4	61 045	64 994	35 006	96 050	56
5	61 073	65 028	34 972	96 045	55
6	61 101	65 062	34 938	96 039	54
7	61 129	65 096	34 904	96 034	53
8	61 158	65 130	34 870	96 028	52
9	61 186	65 164	34 836	96 022	51
10	61 214	65 197	34 803	96 017	50
11	61 242	65 231	34 769	96 011	49
12	61 270	65 265	34 735	96 005	48
13	61 298	65 299	34 701	96 000	47
14	61 326	65 333	34 667	95 994	46
15	61 354	65 366	34 634	95 988	45
16	61 382	65 400	34 600	95 982	44
17	61 411	65 434	34 566	95 977	43
18	61 438	65 467	34 533	95 971	42
19	61 466	65 501	34 499	95 965	41
20	61 494	65 535	34 465	95 960	40
21	61 522	65 568	34 432	95 954	39
22	61 550	65 602	34 398	95 948	38
23	61 578	65 636	34 364	95 942	37
24	61 606	65 669	34 331	95 937	36
25	61 634	65 703	34 297	95 931	35
26	61 662	65 736	34 264	95 925	34
27	61 689	65 770	34 230	95 920	33
28	61 717	65 803	34 197	95 914	32
29	61 745	65 837	34 163	95 908	31
30	61 773	65 870	34 130	95 902	30
31	61 800	65 904	34 096	95 897	29
32	61 828	65 937	34 063	95 891	28
33	61 856	65 971	34 029	95 885	27
34	61 883	66 004	33 996	95 879	26
35	61 911	66 038	33 962	95 873	25
36	61 939	66 071	33 929	95 868	24
37	61 966	66 104	33 896	95 862	23
38	61 994	66 138	33 862	95 856	22
39	62 021	66 171	33 829	95 850	21
40	62 049	66 204	33 796	95 844	20
41	62 076	66 238	33 762	95 839	19
42	62 104	66 271	33 729	95 833	18
43	62 131	66 304	33 696	95 827	17
44	62 159	66 337	33 663	95 821	16
45	62 186	66 371	33 629	95 815	15
46	62 214	66 404	33 596	95 810	14
47	62 241	66 437	33 563	95 804	13
48	62 268	66 470	33 530	95 798	12
49	62 296	66 503	33 497	95 792	11
50	62 323	66 537	33 463	95 786	10
51	62 350	66 570	33 430	95 780	9
52	62 377	66 603	33 397	95 775	8
53	62 405	66 636	33 364	95 769	7
54	62 432	66 669	33 331	95 763	6
55	62 459	66 702	33 298	95 757	5
56	62 486	66 735	33 265	95 751	4
57	62 513	66 768	33 232	95 745	3
58	62 541	66 801	33 199	95 739	2
59	62 568	66 834	33 166	95 733	1
60	62 595	66 867	33 133	95 728	0
	9	9	10	9	
′	log cos	log cot	log tan	log sin	′

65°

25°

′	log sin 9	log tan 9	log cot 10	log cos 9	′
0	62 595	66 867	33 133	95 728	60
1	62 622	66 900	33 100	95 722	59
2	62 649	66 933	33 067	95 716	58
3	62 676	66 966	33 034	95 710	57
4	62 703	66 999	33 001	95 704	56
5	62 730	67 032	32 968	95 698	55
6	62 757	67 065	32 935	95 692	54
7	62 784	67 098	32 902	95 686	53
8	62 811	67 131	32 869	95 680	52
9	62 838	67 163	32 837	95 674	51
10	62 865	67 196	32 804	95 668	50
11	62 892	67 229	32 771	95 663	49
12	62 918	67 262	32 738	95 657	48
13	62 945	67 295	32 705	95 651	47
14	62 972	67 327	32 673	95 645	46
15	62 999	67 360	32 640	95 639	45
16	63 026	67 393	32 607	95 633	44
17	63 052	67 426	32 574	95 627	43
18	63 079	67 458	32 542	95 621	42
19	63 106	67 491	32 509	95 615	41
20	63 133	67 524	32 476	95 609	40
21	63 159	67 556	32 444	95 603	39
22	63 186	67 589	32 411	95 597	38
23	63 213	67 622	32 378	95 591	37
24	63 239	67 654	32 346	95 585	36
25	63 266	67 687	32 313	95 579	35
26	63 292	67 719	32 281	95 573	34
27	63 319	67 752	32 248	95 567	33
28	63 345	67 785	32 215	95 561	32
29	63 372	67 817	32 183	95 555	31
30	63 398	67 850	32 150	95 549	30
31	63 425	67 882	32 118	95 543	29
32	63 451	67 915	32 085	95 537	28
33	63 478	67 947	32 053	95 531	27
34	63 504	67 980	32 020	95 525	26
35	63 531	68 012	31 988	95 519	25
36	63 557	68 044	31 956	95 513	24
37	63 583	68 077	31 923	95 507	23
38	63 610	68 109	31 891	95 500	22
39	63 636	68 142	31 858	95 494	21
40	63 662	68 174	31 826	95 488	20
41	63 689	68 206	31 794	95 482	19
42	63 715	68 239	31 761	95 476	18
43	63 741	68 271	31 729	95 470	17
44	63 767	68 303	31 697	95 464	16
45	63 794	68 336	31 664	95 458	15
46	63 820	68 368	31 632	95 452	14
47	63 846	68 400	31 600	95 446	13
48	63 872	68 432	31 568	95 440	12
49	63 898	68 465	31 535	95 434	11
50	63 924	68 497	31 503	95 427	10
51	63 950	68 529	31 471	95 421	9
52	63 976	68 561	31 439	95 415	8
53	64 002	68 593	31 407	95 409	7
54	64 028	68 626	31 374	95 403	6
55	64 054	68 658	31 342	95 397	5
56	64 080	68 690	31 310	95 391	4
57	64 106	68 722	31 278	95 384	3
58	64 132	68 754	31 246	95 378	2
59	64 158	68 786	31 214	95 372	1
60	64 184	68 818	31 182	95 366	0
	9	9	10	9	
′	log cos	log cot	log tan	log sin	′

26°

′	log sin 9	log tan 9	log cot 10	log cos 9	′
0	64 184	68 818	31 182	95 366	60
1	64 210	68 850	31 150	95 360	59
2	64 236	68 882	31 118	95 354	58
3	64 262	68 914	31 086	95 348	57
4	64 288	68 946	31 054	95 341	56
5	64 313	68 978	31 022	95 335	55
6	64 339	69 010	30 990	95 329	54
7	64 365	69 042	30 958	95 323	53
8	64 391	69 074	30 926	95 317	52
9	64 417	69 106	30 894	95 310	51
10	64 442	69 138	30 862	95 304	50
11	64 468	69 170	30 830	95 298	49
12	64 494	69 202	30 798	95 292	48
13	64 519	69 234	30 766	95 286	47
14	64 545	69 266	30 734	95 279	46
15	64 571	69 298	30 702	95 273	45
16	64 596	69 329	30 671	95 267	44
17	64 622	69 361	30 639	95 261	43
18	64 647	69 393	30 607	95 254	42
19	64 673	69 425	30 575	95 248	41
20	64 698	69 457	30 543	95 242	40
21	64 724	69 488	30 512	95 236	39
22	64 749	69 520	30 480	95 229	38
23	64 775	69 552	30 448	95 223	37
24	64 800	69 584	30 416	95 217	36
25	64 826	69 615	30 385	95 211	35
26	64 851	69 647	30 353	95 204	34
27	64 877	69 679	30 321	95 198	33
28	64 902	69 710	30 290	95 192	32
29	64 927	69 742	30 258	95 185	31
30	64 953	69 774	30 226	95 179	30
31	64 978	69 805	30 195	95 173	29
32	65 003	69 837	30 163	95 167	28
33	65 029	69 868	30 132	95 160	27
34	65 054	69 900	30 100	95 154	26
35	65 079	69 932	30 068	95 148	25
36	65 104	69 963	30 037	95 141	24
37	65 130	69 995	30 005	95 135	23
38	65 155	70 026	29 974	95 129	22
39	65 180	70 058	29 942	95 122	21
40	65 205	70 089	29 911	95 116	20
41	65 230	70 121	29 879	95 110	19
42	65 255	70 152	29 848	95 103	18
43	65 281	70 184	29 816	95 097	17
44	65 306	70 215	29 785	95 090	16
45	65 331	70 247	29 753	95 084	15
46	65 356	70 278	29 722	95 078	14
47	65 381	70 309	29 691	95 071	13
48	65 406	70 341	29 659	95 065	12
49	65 431	70 372	29 628	95 059	11
50	65 456	70 404	29 596	95 052	10
51	65 481	70 435	29 565	95 046	9
52	65 506	70 466	29 534	95 039	8
53	65 531	70 498	29 502	95 033	7
54	65 556	70 529	29 471	95 027	6
55	65 580	70 560	29 440	95 020	5
56	65 605	70 592	29 408	95 014	4
57	65 630	70 623	29 377	95 007	3
58	65 655	70 654	29 346	95 001	2
59	65 680	70 685	29 315	94 995	1
60	65 705	70 717	29 283	94 988	0
	9	9	10	9	
′	log cos	log cot	log tan	log sin	′

64° 63°

27°

′	log sin	log tan	log cot	log cos	′
	9	9	10	9	
0	65 705	70 717	29 283	94 988	60
1	65 729	70 748	29 252	94 982	59
2	65 754	70 779	29 221	94 975	58
3	65 779	70 810	29 190	94 969	57
4	65 804	70 841	29 159	94 962	56
5	65 828	70 873	29 127	94 956	55
6	65 853	70 904	29 096	94 949	54
7	65 878	70 935	29 065	94 943	53
8	65 902	70 966	29 034	94 936	52
9	65 927	70 997	29 003	94 930	51
10	65 952	71 028	28 972	94 923	50
11	65 976	71 059	28 941	94 917	49
12	66 001	71 090	28 910	94 911	48
13	66 025	71 121	28 879	94 904	47
14	66 050	71 153	28 847	94 898	46
15	66 075	71 184	28 816	94 891	45
16	66 099	71 215	28 785	94 885	44
17	66 124	71 246	28 754	94 878	43
18	66 148	71 277	28 723	94 871	42
19	66 173	71 308	28 692	94 865	41
20	66 197	71 339	28 661	94 858	40
21	66 221	71 370	28 630	94 852	39
22	66 246	71 401	28 599	94 845	38
23	66 270	71 431	28 569	94 839	37
24	66 295	71 462	28 538	94 832	36
25	66 319	71 493	28 507	94 826	35
26	66 343	71 524	28 476	94 819	34
27	66 368	71 555	28 445	94 813	33
28	66 392	71 586	28 414	94 806	32
29	66 416	71 617	28 383	94 799	31
30	66 441	71 648	28 352	94 793	30
31	66 465	71 679	28 321	94 786	29
32	66 489	71 709	28 291	94 780	28
33	66 513	71 740	28 260	94 773	27
34	66 537	71 771	28 229	94 767	26
35	66 562	71 802	28 198	94 760	25
36	66 586	71 833	28 167	94 753	24
37	66 610	71 863	28 137	94 747	23
38	66 634	71 894	28 106	94 740	22
39	66 658	71 925	28 075	94 734	21
40	66 682	71 955	28 045	94 727	20
41	66 706	71 986	28 014	94 720	19
42	66 731	72 017	27 983	94 714	18
43	66 755	72 048	27 952	94 707	17
44	66 779	72 078	27 922	94 700	16
45	66 803	72 109	27 891	94 694	15
46	66 827	72 140	27 860	94 687	14
47	66 851	72 170	27 830	94 680	13
48	66 875	72 201	27 799	94 674	12
49	66 899	72 231	27 769	94 667	11
50	66 922	72 262	27 738	94 660	10
51	66 946	72 293	27 707	94 654	9
52	66 970	72 323	27 677	94 647	8
53	66 994	72 354	27 646	94 640	7
54	67 018	72 384	27 616	94 634	6
55	67 042	72 415	27 585	94 627	5
56	67 066	72 445	27 555	94 620	4
57	67 090	72 476	27 524	94 614	3
58	67 113	72 506	27 494	94 607	2
59	67 137	72 537	27 463	94 600	1
60	67 161	72 567	27 433	94 593	0
	9	9	10	9	
′	log cos	log cot	log tan	log sin	′

62°

28°

′	log sin	log tan	log cot	log cos	′
	9	9	10	9	
0	67 161	72 567	27 433	94 593	60
1	67 185	72 598	27 402	94 587	59
2	67 208	72 628	27 372	94 580	58
3	67 232	72 659	27 341	94 573	57
4	67 256	72 689	27 311	94 567	56
5	67 280	72 720	27 280	94 560	55
6	67 303	72 750	27 250	94 553	54
7	67 327	72 780	27 220	94 546	53
8	67 350	72 811	27 189	94 540	52
9	67 374	72 841	27 159	94 533	51
10	67 398	72 872	27 128	94 526	50
11	67 421	72 902	27 098	94 519	49
12	67 445	72 932	27 068	94 513	48
13	67 468	72 963	27 037	94 506	47
14	67 492	72 993	27 007	94 499	46
15	67 515	73 023	26 977	94 492	45
16	67 539	73 054	26 946	94 485	44
17	67 562	73 084	26 916	94 479	43
18	67 586	73 114	26 886	94 472	42
19	67 609	73 144	26 856	94 465	41
20	67 633	73 175	26 825	94 458	40
21	67 656	73 205	26 795	94 451	39
22	67 680	73 235	26 765	94 445	38
23	67 703	73 265	26 735	94 438	37
24	67 726	73 295	26 705	94 431	36
25	67 750	73 326	26 674	94 424	35
26	67 773	73 356	26 644	94 417	34
27	67 796	73 386	26 614	94 410	33
28	67 820	73 416	26 584	94 404	32
29	67 843	73 446	26 554	94 397	31
30	67 866	73 476	26 524	94 390	30
31	67 890	73 507	26 493	94 383	29
32	67 913	73 537	26 463	94 376	28
33	67 936	73 567	26 433	94 369	27
34	67 959	73 597	26 403	94 362	26
35	67 982	73 627	26 373	94 355	25
36	68 006	73 657	26 343	94 349	24
37	68 029	73 687	26 313	94 342	23
38	68 052	73 717	26 283	94 335	22
39	68 075	73 747	26 253	94 328	21
40	68 098	73 777	26 223	94 321	20
41	68 121	73 807	26 193	94 314	19
42	68 144	73 837	26 163	94 307	18
43	68 167	73 867	26 133	94 300	17
44	68 190	73 897	26 103	94 293	16
45	68 213	73 927	26 073	94 286	15
46	68 237	73 957	26 043	94 279	14
47	68 260	73 987	26 013	94 273	13
48	68 283	74 017	25 983	94 266	12
49	68 305	74 047	25 953	94 259	11
50	68 328	74 077	25 923	94 252	10
51	68 351	74 107	25 893	94 245	9
52	68 374	74 137	25 863	94 238	8
53	68 397	74 166	25 834	94 231	7
54	68 420	74 196	25 804	94 224	6
55	68 443	74 226	25 774	94 217	5
56	68 466	74 256	25 744	94 210	4
57	68 489	74 286	25 714	94 203	3
58	68 512	74 316	25 684	94 196	2
59	68 534	74 345	25 655	94 189	1
60	68 557	74 375	25 625	94 182	0
	9	9	10	9	
′	log cos	log cot	log tan	log sin	′

61°

29°

′	log sin −9	log tan −9	log cot −10	log cos −9	′
0	68 557	74 375	25 625	94 182	60
1	68 580	74 405	25 595	94 175	59
2	68 603	74 435	25 565	94 168	58
3	68 625	74 465	25 535	94 161	57
4	68 648	74 494	25 506	94 154	56
5	68 671	74 524	25 476	94 147	55
6	68 694	74 554	25 446	94 140	54
7	68 716	74 583	25 417	94 133	53
8	68 739	74 613	25 387	94 126	52
9	68 762	74 643	25 357	94 119	51
10	68 784	74 673	25 327	94 112	50
11	68 807	74 702	25 298	94 105	49
12	68 829	74 732	25 268	94 098	48
13	68 852	74 762	25 238	94 090	47
14	68 875	74 791	25 209	94 083	46
15	68 897	74 821	25 179	94 076	45
16	68 920	74 851	25 149	94 069	44
17	68 942	74 880	25 120	94 062	43
18	68 965	74 910	25 090	94 055	42
19	68 987	74 939	25 061	94 048	41
20	69 010	74 969	25 031	94 041	40
21	69 032	74 998	25 002	94 034	39
22	69 055	75 028	24 972	94 027	38
23	69 077	75 058	24 942	94 020	37
24	69 100	75 087	24 913	94 012	36
25	69 122	75 117	24 883	94 005	35
26	69 144	75 146	24 854	93 998	34
27	69 167	75 176	24 824	93 991	33
28	69 189	75 205	24 795	93 984	32
29	69 212	75 235	24 765	93 977	31
30	69 234	75 264	24 736	93 970	30
31	69 256	75 294	24 706	93 963	29
32	69 279	75 323	24 677	93 955	28
33	69 301	75 353	24 647	93 948	27
34	69 323	75 382	24 618	93 941	26
35	69 345	75 411	24 589	93 934	25
36	69 368	75 441	24 559	93 927	24
37	69 390	75 470	24 530	93 920	23
38	69 412	75 500	24 500	93 912	22
39	69 434	75 529	24 471	93 905	21
40	69 456	75 558	24 442	93 898	20
41	69 479	75 588	24 412	93 891	19
42	69 501	75 617	24 383	93 884	18
43	69 523	75 647	24 353	93 876	17
44	69 545	75 676	24 324	93 869	16
45	69 567	75 705	24 295	93 862	15
46	69 589	75 735	24 265	93 855	14
47	69 611	75 764	24 236	93 847	13
48	69 633	75 793	24 207	93 840	12
49	69 655	75 822	24 178	93 833	11
50	69 677	75 852	24 148	93 826	10
51	69 699	75 881	24 119	93 819	9
52	69 721	75 910	24 090	93 811	8
53	69 743	75 939	24 061	93 804	7
54	69 765	75 969	24 031	93 797	6
55	69 787	75 998	24 002	93 789	5
56	69 809	76 027	23 973	93 782	4
57	69 831	76 056	23 944	93 775	3
58	69 853	76 086	23 914	93 768	2
59	69 875	76 115	23 885	93 760	1
60	69 897	76 144	23 856	93 753	0
	−9	−9	−10	−9	
′	log cos	log cot	log tan	log sin	′

60°

30°

′	log sin −9	log tan −9	log cot −10	log cos −9	′
0	69 897	76 144	23 856	93 753	60
1	69 919	76 173	23 827	93 746	59
2	69 941	76 202	23 798	93 738	58
3	69 963	76 231	23 769	93 731	57
4	69 984	76 261	23 739	93 724	56
5	70 006	76 290	23 710	93 717	55
6	70 028	76 319	23 681	93 709	54
7	70 050	76 348	28 652	93 702	53
8	70 072	76 377	23 623	93 695	52
9	70 093	76 406	23 594	93 687	51
10	70 115	76 435	23 565	93 680	50
11	70 137	76 464	23 536	93 673	49
12	70 159	76 493	23 507	93 665	48
13	70 180	76 522	23 478	93 658	47
14	70 202	76 551	23 449	93 650	46
15	70 224	76 580	23 420	93 643	45
16	70 245	76 609	23 391	93 636	44
17	70 267	76 639	23 361	93 628	43
18	70 288	76 668	23 332	93 621	42
19	70 310	76 697	23 303	93 614	41
20	70 332	76 725	23 275	93 606	40
21	70 353	76 754	23 246	93 599	39
22	70 375	76 783	23 217	93 591	38
23	70 396	76 812	23 188	93 584	37
24	70 418	76 841	23 159	93 577	36
25	70 439	76 870	23 130	93 569	35
26	70 461	76 899	23 101	93 562	34
27	70 482	76 928	23 072	93 554	33
28	70 504	76 957	23 043	93 547	32
29	70 525	76 986	23 014	93 539	31
30	70 547	77 015	22 985	93 532	30
31	70 568	77 044	22 956	93 525	29
32	70 590	77 073	22 927	93 517	28
33	70 611	77 101	22 899	93 510	27
34	70 633	77 130	22 870	93 502	26
35	70 654	77 159	22 841	93 495	25
36	70 675	77 188	22 812	93 487	24
37	70 697	77 217	22 783	93 480	23
38	70 718	77 246	22 754	93 472	22
39	70 739	77 274	22 726	93 465	21
40	70 761	77 303	22 697	93 457	20
41	70 782	77 332	22 668	93 450	19
42	70 803	77 361	22 639	93 442	18
43	70 824	77 390	22 610	93 435	17
44	70 846	77 418	22 582	93 427	16
45	70 867	77 447	22 553	93 420	15
46	70 888	77 476	22 524	93 412	14
47	70 909	77 505	22 495	93 405	13
48	70 931	77 533	22 467	93 397	12
49	70 952	77 562	22 438	93 390	11
50	70 973	77 591	22 409	93 382	10
51	70 994	77 619	22 381	93 375	9
52	71 015	77 648	22 352	93 367	8
53	71 036	77 677	22 323	93 360	7
54	71 058	77 706	22 294	93 352	6
55	71 079	77 734	22 266	93 344	5
56	71 100	77 763	22 237	93 337	4
57	71 121	77 791	22 209	93 329	3
58	71 142	77 820	22 180	93 322	2
59	71 163	77 849	22 151	93 314	1
60	71 184	77 877	22 123	93 307	0
	−9	−9	−10	−9	
′	log cos	log cot	log tan	log sin	′

59°

31°

′	log sin	log tan	log cot	log cos	′
	9	9	10	9	
0	71 184	77 877	22 123	93 307	60
1	71 205	77 906	22 094	93 299	59
2	71 226	77 935	22 065	93 291	58
3	71 247	77 963	22 037	93 284	57
4	71 268	77 992	22 008	93 276	56
5	71 289	78 020	21 980	93 269	55
6	71 310	78 049	21 951	93 261	54
7	71 331	78 077	21 923	93 253	53
8	71 352	78 106	21 894	93 246	52
9	71 373	78 135	21 865	93 238	51
10	71 393	78 163	21 837	93 230	50
11	71 414	78 192	21 808	93 223	49
12	71 435	78 220	21 780	93 215	48
13	71 456	78 249	21 751	93 207	47
14	71 477	78 277	21 723	93 200	46
15	71 498	78 306	21 694	93 192	45
16	71 519	78 334	21 666	93 184	44
17	71 539	78 363	21 637	93 177	43
18	71 560	78 391	21 609	93 169	42
19	71 581	78 419	21 581	93 161	41
20	71 602	78 448	21 552	93 154	40
21	71 622	78 476	21 524	93 146	39
22	71 643	78 505	21 495	93 138	38
23	71 664	78 533	21 467	93 131	37
24	71 685	78 562	21 438	93 123	36
25	71 705	78 590	21 410	93 115	35
26	71 726	78 618	21 382	93 108	34
27	71 747	78 647	21 353	93 100	33
28	71 767	78 675	21 325	93 092	32
29	71 788	78 704	21 296	93 084	31
30	71 809	78 732	21 268	93 077	30
31	71 829	78 760	21 240	93 069	29
32	71 850	78 789	21 211	93 061	28
33	71 870	78 817	21 183	93 053	27
34	71 891	78 845	21 155	93 046	26
35	71 911	78 874	21 126	93 038	25
36	71 932	78 902	21 098	93 030	24
37	71 952	78 930	21 070	93 022	23
38	71 973	78 959	21 041	93 014	22
39	71 994	78 987	21 013	93 007	21
40	72 014	79 015	20 985	92 999	20
41	72 034	79 043	20 957	92 991	19
42	72 055	79 072	20 928	92 983	18
43	72 075	79 100	20 900	92 976	17
44	72 096	79 128	20 872	92 968	16
45	72 116	79 156	20 844	92 960	15
46	72 137	79 185	20 815	92 952	14
47	72 157	79 213	20 787	92 944	13
48	72 177	79 241	20 759	92 936	12
49	72 198	79 269	20 731	92 929	11
50	72 218	79 297	20 703	92 921	10
51	72 238	79 326	20 674	92 913	9
52	72 259	79 354	20 646	92 905	8
53	72 279	79 382	20 618	92 897	7
54	72 299	79 410	20 590	92 889	6
55	72 320	79 438	20 562	92 881	5
56	72 340	79 466	20 534	92 874	4
57	72 360	79 495	20 505	92 866	3
58	72 381	79 523	20 477	92 858	2
59	72 401	79 551	20 449	92 850	1
60	72 421	79 579	20 421	92 842	0
	9	9	10	9	
′	log cos	log cot	log tan	log sin	′

32°

′	log sin	log tan	log cot	log cos	′
	9	9	10	9	
0	72 421	79 579	20 421	92 842	60
1	72 441	79 607	20 393	92 834	59
2	72 461	79 635	20 365	92 826	58
3	72 482	79 663	20 337	92 818	57
4	72 502	79 691	20 309	92 810	56
5	72 522	79 719	20 281	92 803	55
6	72 542	79 747	20 253	92 795	54
7	72 562	79 776	20 224	92 787	53
8	72 582	79 804	20 196	92 779	52
9	72 602	79 832	20 168	92 771	51
10	72 622	79 860	20 140	92 763	50
11	72 643	79 888	20 112	92 755	49
12	72 663	79 916	20 084	92 747	48
13	72 683	79 944	20 056	92 739	47
14	72 703	79 972	20 028	92 731	46
15	72 723	80 000	20 000	92 723	45
16	72 743	80 028	19 972	92 715	44
17	72 763	80 056	19 944	92 707	43
18	72 783	80 084	19 916	92 699	42
19	72 803	80 112	19 888	92 691	41
20	72 823	80 140	19 860	92 683	40
21	72 843	80 168	19 832	92 675	39
22	72 863	80 195	19 805	92 667	38
23	72 883	80 223	19 777	92 659	37
24	72 902	80 251	19 749	92 651	36
25	72 922	80 279	19 721	92 643	35
26	72 942	80 307	19 693	92 635	34
27	72 962	80 335	19 665	92 627	33
28	72 982	80 363	19 637	92 619	32
29	73 002	80 391	19 609	92 611	31
30	73 022	80 419	19 581	92 603	30
31	73 041	80 447	19 553	92 595	29
32	73 061	80 474	19 526	92 587	28
33	73 081	80 502	19 498	92 579	27
34	73 101	80 530	19 470	92 571	26
35	73 121	80 558	19 442	92 563	25
36	73 140	80 586	19 414	92 555	24
37	73 160	80 614	19 386	92 546	23
38	73 180	80 642	19 358	92 538	22
39	73 200	80 669	19 331	92 530	21
40	73 219	80 697	19 303	92 522	20
41	73 239	80 725	19 275	92 514	19
42	73 259	80 753	19 247	92 506	18
43	73 278	80 781	19 219	92 498	17
44	73 298	80 808	19 192	92 490	16
45	73 318	80 836	19 164	92 482	15
46	73 337	80 864	19 136	92 473	14
47	73 357	80 892	19 108	92 465	13
48	73 377	80 919	19 081	92 457	12
49	73 396	80 947	19 053	92 449	11
50	73 416	80 975	19 025	92 441	10
51	73 435	81 003	18 997	92 433	9
52	73 455	81 030	18 970	92 425	8
53	73 474	81 058	18 942	92 416	7
54	73 494	81 086	18 914	92 408	6
55	73 513	81 113	18 887	92 400	5
56	73 533	81 141	18 859	92 392	4
57	73 552	81 169	18 831	92 384	3
58	73 572	81 196	18 804	92 376	2
59	73 591	81 224	18 776	92 367	1
60	73 611	81 252	18 748	92 359	0
	9	9	10	9	
′	log cos	log cot	log tan	log sin	′

58°

57°

33°

′	log sin	log tan	log cot	log cos	′
	9	9	10	9	
0	73 611	81 252	18 748	92 359	60
1	73 630	81 279	18 721	92 351	59
2	73 650	81 307	18 693	92 343	58
3	73 669	81 335	18 665	92 335	57
4	73 689	81 362	18 638	92 326	56
5	73 708	81 390	18 610	92 318	55
6	73 727	81 418	18 582	92 310	54
7	73 747	81 445	18 555	92 302	53
8	73 766	81 473	18 527	92 293	52
9	73 785	81 500	18 500	92 285	51
10	73 805	81 528	18 472	92 277	50
11	73 824	81 556	18 444	92 269	49
12	73 843	81 583	18 417	92 260	48
13	73 863	81 611	18 389	92 252	47
14	73 882	81 638	18 362	92 244	46
15	73 901	81 666	18 334	92 235	45
16	73 921	81 693	18 307	92 227	44
17	73 940	81 721	18 279	92 219	43
18	73 959	81 748	18 252	92 211	42
19	73 978	81 776	18 224	92 202	41
20	73 997	81 803	18 197	92 194	40
21	74 017	81 831	18 169	92 186	39
22	74 036	81 858	18 142	92 177	38
23	74 055	81 886	18 114	92 169	37
24	74 074	81 913	18 087	92 161	36
25	74 093	81 941	18 059	92 152	35
26	74 113	81 968	18 032	92 144	34
27	74 132	81 996	18 004	92 136	33
28	74 151	82 023	17 977	92 127	32
29	74 170	82 051	17 949	92 119	31
30	74 189	82 078	17 922	92 111	30
31	74 208	82 106	17 894	92 102	29
32	74 227	82 133	17 867	92 094	28
33	74 246	82 161	17 839	92 086	27
34	74 265	82 188	17 812	92 077	26
35	74 284	82 215	17 785	92 069	25
36	74 303	82 243	17 757	92 060	24
37	74 322	82 270	17 730	92 052	23
38	74 341	82 298	17 702	92 044	22
39	74 360	82 325	17 675	92 035	21
40	74 379	82 352	17 648	92 027	20
41	74 398	82 380	17 620	92 018	19
42	74 417	82 407	17 593	92 010	18
43	74 436	82 435	17 565	92 002	17
44	74 455	82 462	17 538	91 993	16
45	74 474	82 489	17 511	91 985	15
46	74 493	82 517	17 483	91 976	14
47	74 512	82 544	17 456	91 968	13
48	74 531	82 571	17 429	91 959	12
49	74 549	82 599	17 401	91 951	11
50	74 568	82 626	17 374	91 942	10
51	74 587	82 653	17 347	91 934	9
52	74 606	82 681	17 319	91 925	8
53	74 625	82 708	17 292	91 917	7
54	74 644	82 735	17 265	91 908	6
55	74 662	82 762	17 238	91 900	5
56	74 681	82 790	17 210	91 891	4
57	74 700	82 817	17 183	91 883	3
58	74 719	82 844	17 156	91 874	2
59	74 737	82 871	17 129	91 866	1
60	74 756	82 899	17 101	91 857	0
	9	9	10	9	
′	log cos	log cot	log tan	log sin	′

34°

′	log sin	log tan	log cot	log cos	′
	9	9	10	9	
0	74 756	82 899	17 101	91 857	60
1	74 775	82 926	17 074	91 849	59
2	74 794	82 953	17 047	91 840	58
3	74 812	82 980	17 020	91 832	57
4	74 831	83 008	16 992	91 823	56
5	74 850	83 035	16 965	91 815	55
6	74 868	83 062	16 938	91 806	54
7	74 887	83 089	16 911	91 798	53
8	74 906	83 117	16 883	91 789	52
9	74 924	83 144	16 856	91 781	51
10	74 943	83 171	16 829	91 772	50
11	74 961	83 198	16 802	91 763	49
12	74 980	83 225	16 775	91 755	48
13	74 999	83 252	16 748	91 746	47
14	75 017	83 280	16 720	91 738	46
15	75 036	83 307	16 693	91 729	45
16	75 054	83 334	16 666	91 720	44
17	75 073	83 361	16 639	91 712	43
18	75 091	83 388	16 612	91 703	42
19	75 110	83 415	16 585	91 695	41
20	75 128	83 442	16 558	91 686	40
21	75 147	83 470	16 530	91 677	39
22	75 165	83 497	16 503	91 669	38
23	75 184	83 524	16 476	91 660	37
24	75 202	83 551	16 449	91 651	36
25	75 221	83 578	16 422	91 643	35
26	75 239	83 605	16 395	91 634	34
27	75 258	83 632	16 368	91 625	33
28	75 276	83 659	16 341	91 617	32
29	75 294	83 686	16 314	91 608	31
30	75 313	83 713	16 287	91 599	30
31	75 331	83 740	16 260	91 591	29
32	75 350	83 768	16 232	91 582	28
33	75 368	83 795	16 205	91 573	27
34	75 386	83 822	16 178	91 565	26
35	75 405	83 849	16 151	91 556	25
36	75 423	83 876	16 124	91 547	24
37	75 441	83 903	16 097	91 538	23
38	75 459	83 930	16 070	91 530	22
39	75 478	83 957	16 043	91 521	21
40	75 496	83 984	16 016	91 512	20
41	75 514	84 011	15 989	91 504	19
42	75 533	84 038	15 962	91 495	18
43	75 551	84 065	15 935	91 486	17
44	75 569	84 092	15 908	91 477	16
45	75 587	84 119	15 881	91 469	15
46	75 605	84 146	15 854	91 460	14
47	75 624	84 173	15 827	91 451	13
48	75 642	84 200	15 800	91 442	12
49	75 660	84 227	15 773	91 433	11
50	75 678	84 254	15 746	91 425	10
51	75 696	84 280	15 720	91 416	9
52	75 714	84 307	15 693	91 407	8
53	75 733	84 334	15 666	91 398	7
54	75 751	84 361	15 639	91 389	6
55	75 769	84 388	15 612	91 381	5
56	75 787	84 415	15 585	91 372	4
57	75 805	84 442	15 558	91 363	3
58	75 823	84 469	15 531	91 354	2
59	75 841	84 496	15 504	91 345	1
60	75 859	84 523	15 477	91 336	0
	9	9	10	9	
′	log cos	log cot	log tan	log sin	′

35°

′	log sin	log tan	log cot	log cos	′
	9	9	10	9	
0	75 859	84 523	15 477	91 336	60
1	75 877	84 550	15 450	91 328	59
2	75 895	84 576	15 424	91 319	58
3	75 913	84 603	15 397	91 310	57
4	75 931	84 630	15 370	91 301	56
5	75 949	84 657	15 343	91 292	55
6	75 967	84 684	15 316	91 283	54
7	75 985	84 711	15 289	91 274	53
8	76 003	84 738	15 262	91 266	52
9	76 021	84 764	15 236	91 257	51
10	76 039	84 791	15 209	91 248	50
11	76 057	84 818	15 182	91 239	49
12	76 075	84 845	15 155	91 230	48
13	76 093	84 872	15 128	91 221	47
14	76 111	84 899	15 101	91 212	46
15	76 129	84 925	15 075	91 203	45
16	76 146	84 952	15 048	91 194	44
17	76 164	84 979	15 021	91 185	43
18	76 182	85 006	14 994	91 176	42
19	76 200	85 033	14 967	91 167	41
20	76 218	85 059	14 941	91 158	40
21	76 236	85 086	14 914	91 149	39
22	76 253	85 113	14 887	91 141	38
23	76 271	85 140	14 860	91 132	37
24	76 289	85 166	14 834	91 123	36
25	76 307	85 193	14 807	91 114	35
26	76 324	85 220	14 780	91 105	34
27	76 342	85 247	14 753	91 096	33
28	76 360	85 273	14 727	91 087	32
29	76 378	85 300	14 700	91 078	31
30	76 395	85 327	14 673	91 069	30
31	76 413	85 354	14 646	91 060	29
32	76 431	85 380	14 620	91 051	28
33	76 448	85 407	14 593	91 042	27
34	76 466	85 434	14 566	91 033	26
35	76 484	85 460	14 540	91 023	25
36	76 501	85 487	14 513	91 014	24
37	76 519	85 514	14 486	91 005	23
38	76 537	85 540	14 460	90 996	22
39	76 554	85 567	14 433	90 987	21
40	76 572	85 594	14 406	90 978	20
41	76 590	85 620	14 380	90 969	19
42	76 607	85 647	14 353	90 960	18
43	76 625	85 674	14 326	90 951	17
44	76 642	85 700	14 300	90 942	16
45	76 660	85 727	14 273	90 933	15
46	76 677	85 754	14 246	90 924	14
47	76 695	85 780	14 220	90 915	13
48	76 712	85 807	14 193	90 906	12
49	76 730	85 834	14 166	90 896	11
50	76 747	85 860	14 140	90 887	10
51	76 765	85 887	14 113	90 878	9
52	76 782	85 913	14 087	90 869	8
53	76 800	85 940	14 060	90 860	7
54	76 817	85 967	14 033	90 851	6
55	76 835	85 993	14 007	90 842	5
56	76 852	86 020	13 980	90 832	4
57	76 870	86 046	13 954	90 823	3
58	76 887	86 073	13 927	90 814	2
59	76 904	86 100	13 900	90 805	1
60	76 922	86 126	13 874	90 796	0
	9	9	10	9	
′	log cos	log cot	log tan	log sin	′

36°

′	log sin	log tan	log cot	log cos	′
	9	9	10	9	
0	76 922	86 126	13 874	90 796	60
1	76 939	86 153	13 847	90 787	59
2	76 957	86 179	13 821	90 777	58
3	76 974	86 206	13 794	90 768	57
4	76 991	86 232	13 768	90 759	56
5	77 009	86 259	13 741	90 750	55
6	77 026	86 285	13 715	90 741	54
7	77 043	86 312	13 688	90 731	53
8	77 061	86 338	13 662	90 722	52
9	77 078	86 365	13 635	90 713	51
10	77 095	86 392	13 608	90 704	50
11	77 112	86 418	13 582	90 694	49
12	77 130	86 445	13 555	90 685	48
13	77 147	86 471	13 529	90 676	47
14	77 164	86 498	13 502	90 667	46
15	77 181	86 524	13 476	90 657	45
16	77 199	86 551	13 449	90 648	44
17	77 216	86 577	13 423	90 639	43
18	77 233	86 603	13 397	90 630	42
19	77 250	86 630	13 370	90 620	41
20	77 268	86 656	13 344	90 611	40
21	77 285	86 683	13 317	90 602	39
22	77 302	86 709	13 291	90 592	38
23	77 319	86 736	13 264	90 583	37
24	77 336	86 762	13 238	90 574	36
25	77 353	86 789	13 211	90 565	35
26	77 370	86 815	13 185	90 555	34
27	77 387	86 842	13 158	90 546	33
28	77 405	86 868	13 132	90 537	32
29	77 422	86 894	13 106	90 527	31
30	77 439	86 921	13 079	90 518	30
31	77 456	86 947	13 053	90 509	29
32	77 473	86 974	13 026	90 499	28
33	77 490	87 000	13 000	90 490	27
34	77 507	87 027	12 973	90 480	26
35	77 524	87 053	12 947	90 471	25
36	77 541	87 079	12 921	90 462	24
37	77 558	87 106	12 894	90 452	23
38	77 575	87 132	12 868	90 443	22
39	77 592	87 158	12 842	90 434	21
40	77 609	87 185	12 815	90 424	20
41	77 626	87 211	12 789	90 415	19
42	77 643	87 238	12 762	90 405	18
43	77 660	87 264	12 736	90 396	17
44	77 677	87 290	12 710	90 386	16
45	77 694	87 317	12 683	90 377	15
46	77 711	87 343	12 657	90 368	14
47	77 728	87 369	12 631	90 358	13
48	77 744	87 396	12 604	90 349	12
49	77 761	87 422	12 578	90 339	11
50	77 778	87 448	12 552	90 330	10
51	77 795	87 475	12 525	90 320	9
52	77 812	87 501	12 499	90 311	8
53	77 829	87 527	12 473	90 301	7
54	77 846	87 554	12 446	90 292	6
55	77 862	87 580	12 420	90 282	5
56	77 879	87 606	12 394	90 273	4
57	77 896	87 633	12 367	90 263	3
58	77 913	87 659	12 341	90 254	2
59	77 930	87 685	12 315	90 244	1
60	77 946	87 711	12 289	90 235	0
	9	9	10	9	
′	log cos	log cot	log tan	log sin	′

54°

53°

37°

′	log sin	log tan	log cot	log cos	′
	9	9	10	9	
0	77 946	87 711	12 289	90 235	60
1	77 963	87 738	12 262	90 225	59
2	77 980	87 764	12 236	90 216	58
3	77 997	87 790	12 210	90 206	57
4	78 013	87 817	12 183	90 197	56
5	78 030	87 843	12 157	90 187	55
6	78 047	87 869	12 131	90 178	54
7	78 063	87 895	12 105	90 168	53
8	78 080	87 922	12 078	90 159	52
9	78 097	87 948	12 052	90 149	51
10	78 113	87 974	12 026	90 139	50
11	78 130	88 000	12 000	90 130	49
12	78 147	88 027	11 973	90 120	48
13	78 163	88 053	11 947	90 111	47
14	78 180	88 079	11 921	90 101	46
15	78 197	88 105	11 895	90 091	45
16	78 213	88 131	11 869	90 082	44
17	78 230	88 158	11 842	90 072	43
18	78 246	88 184	11 816	90 063	42
19	78 263	88 210	11 790	90 053	41
20	78 280	88 236	11 764	90 043	40
21	78 296	88 262	11 738	90 034	39
22	78 313	88 289	11 711	90 024	38
23	78 329	88 315	11 685	90 014	37
24	78 346	88 341	11 659	90 005	36
25	78 362	88 367	11 633	89 995	35
26	78 379	88 393	11 607	89 985	34
27	78 395	88 420	11 580	89 976	33
28	78 412	88 446	11 554	89 966	32
29	78 428	88 472	11 528	89 956	31
30	78 445	88 498	11 502	89 947	30
31	78 461	88 524	11 476	89 937	29
32	78 478	88 550	11 450	89 927	28
33	78 494	88 577	11 423	89 918	27
34	78 510	88 603	11 397	89 908	26
35	78 527	88 629	11 371	89 898	25
36	78 543	88 655	11 345	89 888	24
37	78 560	88 681	11 319	89 879	23
38	78 576	88 707	11 293	89 869	22
39	78 592	88 733	11 267	89 859	21
40	78 609	88 759	11 241	89 849	20
41	78 625	88 786	11 214	89 840	19
42	78 642	88 812	11 188	89 830	18
43	78 658	88 838	11 162	89 820	17
44	78 674	88 864	11 136	89 810	16
45	78 691	88 890	11 110	89 801	15
46	78 707	88 916	11 084	89 791	14
47	78 723	88 942	11 058	89 781	13
48	78 739	88 968	11 032	89 771	12
49	78 756	88 994	11 006	89 761	11
50	78 772	89 020	10 980	89 752	10
51	78 788	89 046	10 954	89 742	9
52	78 805	89 073	10 927	89 732	8
53	78 821	89 099	10 901	89 722	7
54	78 837	89 125	10 875	89 712	6
55	78 853	89 151	10 849	89 702	5
56	78 869	89 177	10 823	89 693	4
57	78 886	89 203	10 797	89 683	3
58	78 902	89 229	10 771	89 673	2
59	78 918	89 255	10 745	89 663	1
60	78 934	89 281	10 719	89 653	0
	9	9	10	9	
′	log cos	log cot	log tan	log sin	′

38°

′	log sin	log tan	log cot	log cos	′
	9	9	10	9	
0	78 934	89 281	10 719	89 653	60
1	78 950	89 307	10 693	89 643	59
2	78 967	89 333	10 667	89 633	58
3	78 983	89 359	10 641	89 624	57
4	78 999	89 385	10 615	89 614	56
5	79 015	89 411	10 589	89 604	55
6	79 031	89 437	10 563	89 594	54
7	79 047	89 463	10 537	89 584	53
8	79 063	89 489	10 511	89 574	52
9	79 079	89 515	10 485	89 564	51
10	79 095	89 541	10 459	89 554	50
11	79 111	89 567	10 433	89 544	49
12	79 128	89 593	10 407	89 534	48
13	79 144	89 619	10 381	89 524	47
14	79 160	89 645	10 355	89 514	46
15	79 176	89 671	10 329	89 504	45
16	79 192	89 697	10 303	89 495	44
17	79 208	89 723	10 277	89 485	43
18	79 224	89 749	10 251	89 475	42
19	79 240	89 775	10 225	89 465	41
20	79 256	89 801	10 199	89 455	40
21	79 272	89 827	10 173	89 445	39
22	79 288	89 853	10 147	89 435	38
23	79 304	89 879	10 121	89 425	37
24	79 319	89 905	10 095	89 415	36
25	79 335	89 931	10 069	89 405	35
26	79 351	89 957	10 043	89 395	34
27	79 367	89 983	10 017	89 385	33
28	79 383	90 009	09 991	89 375	32
29	79 399	90 035	09 965	89 364	31
30	79 415	90 061	09 939	89 354	30
31	79 431	90 086	09 914	89 344	29
32	79 447	90 112	09 888	89 334	28
33	79 463	90 138	09 862	89 324	27
34	79 478	90 164	09 836	89 314	26
35	79 494	90 190	09 810	89 304	25
36	79 510	90 216	09 784	89 294	24
37	79 526	90 242	09 758	89 284	23
38	79 542	90 268	09 732	89 274	22
39	79 558	90 294	09 706	89 264	21
40	79 573	90 320	09 680	89 254	20
41	79 589	90 346	09 654	89 244	19
42	79 605	90 371	09 629	89 233	18
43	79 621	90 397	09 603	89 223	17
44	79 636	90 423	09 577	89 213	16
45	79 652	90 449	09 551	89 203	15
46	79 668	90 475	09 525	89 193	14
47	79 684	90 501	09 499	89 183	13
48	79 699	90 527	09 473	89 173	12
49	79 715	90 553	09 447	89 162	11
50	79 731	90 578	09 422	89 152	10
51	79 746	90 604	09 396	89 142	9
52	79 762	90 630	09 370	89 132	8
53	79 778	90 656	09 344	89 122	7
54	79 793	90 682	09 318	89 112	6
55	79 809	90 708	09 292	89 101	5
56	79 825	90 734	09 266	89 091	4
57	79 840	90 759	09 241	89 081	3
58	79 856	90 785	09 215	89 071	2
59	79 872	90 811	09 189	89 060	1
60	79 887	90 837	09 163	89 050	0
	9	9	10	9	
′	log cos	log cot	log tan	log sin	′

52°

51°

39°

′	log sin	log tan	log cot	log cos	′
	9	9	10	9	
0	79 887	90 837	09 163	89 050	60
1	79 903	90 863	09 137	89 040	59
2	79 918	90 889	09 111	89 030	58
3	79 934	90 914	09 086	89 020	57
4	79 950	90 940	09 060	89 009	56
5	79 965	90 966	09 034	88 999	55
6	79 981	90 992	09 008	88 989	54
7	79 996	91 018	08 982	88 978	53
8	80 012	91 043	08 957	88 968	52
9	80 027	91 069	08 931	88 958	51
10	80 043	91 095	08 905	88 948	50
11	80 058	91 121	08 879	88 937	49
12	80 074	91 147	08 853	88 927	48
13	80 089	91 172	08 828	88 917	47
14	80 105	91 198	08 802	88 906	46
15	80 120	91 224	08 776	88 896	45
16	80 136	91 250	08 750	88 886	44
17	80 151	91 276	08 724	88 875	43
18	80 166	91 301	08 699	88 865	42
19	80 182	91 327	08 673	88 855	41
20	80 197	91 353	08 647	88 844	40
21	80 213	91 379	08 621	88 834	39
22	80 228	91 404	08 596	88 824	38
23	80 244	91 430	08 570	88 813	37
24	80 259	91 456	08 544	88 803	36
25	80 274	91 482	08 518	88 793	35
26	80 290	91 507	08 493	88 782	34
27	80 305	91 533	08 467	88 772	33
28	80 320	91 559	08 441	88 761	32
29	80 336	91 585	08 415	88 751	31
30	80 351	91 610	08 390	88 741	30
31	80 366	91 636	08 364	88 730	29
32	80 382	91 662	08 338	88 720	28
33	80 397	91 688	08 312	88 709	27
34	80 412	91 713	08 287	88 699	26
35	80 428	91 739	08 261	88 688	25
36	80 443	91 765	08 235	88 678	24
37	80 458	91 791	08 209	88 668	23
38	80 473	91 816	08 184	88 657	22
39	80 489	91 842	08 158	88 647	21
40	80 504	91 868	08 132	88 636	20
41	80 519	91 893	08 107	88 626	19
42	80 534	91 919	08 081	88 615	18
43	80 550	91 945	08 055	88 605	17
44	80 565	91 971	08 029	88 594	16
45	80 580	91 996	08 004	88 584	15
46	80 595	92 022	07 978	88 573	14
47	80 610	92 048	07 952	88 563	13
48	80 625	92 073	07 927	88 552	12
49	80 641	92 099	07 901	88 542	11
50	80 656	92 125	07 875	88 531	10
51	80 671	92 150	07 850	88 521	9
52	80 686	92 176	07 824	88 510	8
53	80 701	92 202	07 798	88 499	7
54	80 716	92 227	07 773	88 489	6
55	80 731	92 253	07 747	88 478	5
56	80 746	92 279	07 721	88 468	4
57	80 762	92 304	07 696	88 457	3
58	80 777	92 330	07 670	88 447	2
59	80 792	92 356	07 644	88 436	1
60	80 807	92 381	07 619	88 425	0
	9	9	10	9	
′	log cos	log cot	log tan	log sin	′

40°

′	log sin	log tan	log cot	log cos	′
	9	9	10	9	
0	80 807	92 381	07 619	88 425	60
1	80 822	92 407	07 593	88 415	59
2	80 837	92 433	07 567	88 404	58
3	80 852	92 458	07 542	88 394	57
4	80 867	92 484	07 516	88 383	56
5	80 882	92 510	07 490	88 372	55
6	80 897	92 535	07 465	88 362	54
7	80 912	92 561	07 439	88 351	53
8	80 927	92 587	07 413	88 340	52
9	80 942	92 612	07 388	88 330	51
10	80 957	92 638	07 362	88 319	50
11	80 972	92 663	07 337	88 308	49
12	80 987	92 689	07 311	88 298	48
13	81 002	92 715	07 285	88 287	47
14	81 017	92 740	07 260	88 276	46
15	81 032	92 766	07 234	88 266	45
16	81 047	92 792	07 208	88 255	44
17	81 061	92 817	07 183	88 244	43
18	81 076	92 843	07 157	88 234	42
19	81 091	92 868	07 132	88 223	41
20	81 106	92 894	07 106	88 212	40
21	81 121	92 920	07 080	88 201	39
22	81 136	92 945	07 055	88 191	38
23	81 151	92 971	07 029	88 180	37
24	81 166	92 996	07 004	88 169	36
25	81 180	93 022	06 978	88 158	35
26	81 195	93 048	06 952	88 148	34
27	81 210	93 073	06 927	88 137	33
28	81 225	93 099	06 901	88 126	32
29	81 240	93 124	06 876	88 115	31
30	81 254	93 150	06 850	88 105	30
31	81 269	93 175	06 825	88 094	29
32	81 284	93 201	06 799	88 083	28
33	81 299	93 227	06 773	88 072	27
34	81 314	93 252	06 748	88 061	26
35	81 328	93 278	06 722	88 051	25
36	81 343	93 303	06 697	88 040	24
37	81 358	93 329	06 671	88 029	23
38	81 372	93 354	06 646	88 018	22
39	81 387	93 380	06 620	88 007	21
40	81 402	93 406	06 594	87 996	20
41	81 417	93 431	06 569	87 985	19
42	81 431	93 457	06 543	87 975	18
43	81 446	93 482	06 518	87 964	17
44	81 461	93 508	06 492	87 953	16
45	81 475	93 533	06 467	87 942	15
46	81 490	93 559	06 441	87 931	14
47	81 505	93 584	06 416	87 920	13
48	81 519	93 610	06 390	87 909	12
49	81 534	93 636	06 364	87 898	11
50	81 549	93 661	06 339	87 887	10
51	81 563	93 687	06 313	87 877	9
52	81 578	93 712	06 288	87 866	8
53	81 592	93 738	06 262	87 855	7
54	81 607	93 763	06 237	87 844	6
55	81 622	93 789	06 211	87 833	5
56	81 636	93 814	06 186	87 822	4
57	81 651	93 840	06 160	87 811	3
58	81 665	93 865	06 135	87 800	2
59	81 680	93 891	06 109	87 789	1
60	81 694	93 916	06 084	87 778	0
	9	9	10	9	
′	log cos	log cot	log tan	log sin	′

50°

49°

41°

′	log sin	log tan	log cot	log cos	′
	9	9	10	9	
0	81 694	93 916	06 084	87 778	60
1	81 709	93 942	06 058	87 767	59
2	81 723	93 967	06 033	87 756	58
3	81 738	93 993	06 007	87 745	57
4	81 752	94 018	05 982	87 734	56
5	81 767	94 044	05 956	87 723	55
6	81 781	94 069	05 931	87 712	54
7	81 796	94 095	05 905	87 701	53
8	81 810	94 120	05 880	87 690	52
9	81 825	94 146	05 854	87 679	51
10	81 839	94 171	05 829	87 668	50
11	81 854	94 197	05 803	87 657	49
12	81 868	94 222	05 778	87 646	48
13	81 882	94 248	05 752	87 635	47
14	81 897	94 273	05 727	87 624	46
15	81 911	94 299	05 701	87 613	45
16	81 926	94 324	05 676	87 601	44
17	81 940	94 350	05 650	87 590	43
18	81 955	94 375	05 625	87 579	42
19	81 969	94 401	05 599	87 568	41
20	81 983	94 426	05 574	87 557	40
21	81 998	94 452	05 548	87 546	39
22	82 012	94 477	05 523	87 535	38
23	82 026	94 503	05 497	87 524	37
24	82 041	94 528	05 472	87 513	36
25	82 055	94 554	05 446	87 501	35
26	82 069	94 579	05 421	87 490	34
27	82 084	94 604	05 396	87 479	33
28	82 098	94 630	05 370	87 468	32
29	82 112	94 655	05 345	87 457	31
30	82 126	94 681	05 319	87 446	30
31	82 141	94 706	05 294	87 434	29
32	82 155	94 732	05 268	87 423	28
33	82 169	94 757	05 243	87 412	27
34	82 184	94 783	05 217	87 401	26
35	82 198	94 808	05 192	87 390	25
36	82 212	94 834	05 166	87 378	24
37	82 226	94 859	05 141	87 367	23
38	82 240	94 884	05 116	87 356	22
39	82 255	94 910	05 090	87 345	21
40	82 269	94 935	05 065	87 334	20
41	82 283	94 961	05 039	87 322	19
42	82 297	94 986	05 014	87 311	18
43	82 311	95 012	04 988	87 300	17
44	82 326	95 037	04 963	87 288	16
45	82 340	95 062	04 938	87 277	15
46	82 354	95 088	04 912	87 266	14
47	82 368	95 113	04 887	87 255	13
48	82 382	95 139	04 861	87 243	12
49	82 396	95 164	04 836	87 232	11
50	82 410	95 190	04 810	87 221	10
51	82 424	95 215	04 785	87 209	9
52	82 439	95 240	04 760	87 198	8
53	82 453	95 266	04 734	87 187	7
54	82 467	95 291	04 709	87 175	6
55	82 481	95 317	04 683	87 164	5
56	82 495	95 342	04 658	87 153	4
57	82 509	95 368	04 632	87 141	3
58	82 523	95 393	04 607	87 130	2
59	82 537	95 418	04 582	87 119	1
60	82 551	95 444	04 556	87 107	0
	9	9	10	9	
′	log cos	log cot	log tan	log sin	′

42°

′	log sin	log tan	log cot	log cos	′
	9	9	10	9	
0	82 551	95 444	04 556	87 107	60
1	82 565	95 469	04 531	87 096	59
2	82 579	95 495	04 505	87 085	58
3	82 593	95 520	04 480	87 073	57
4	82 607	95 545	04 455	87 062	56
5	82 621	95 571	04 429	87 050	55
6	82 635	95 596	04 404	87 039	54
7	82 649	95 622	04 378	87 028	53
8	82 663	95 647	04 353	87 016	52
9	82 677	95 672	04 328	87 005	51
10	82 691	95 698	04 302	86 993	50
11	82 705	95 723	04 277	86 982	49
12	82 719	95 748	04 252	86 970	48
13	82 733	95 774	04 226	86 959	47
14	82 747	95 799	04 201	86 947	46
15	82 761	95 825	04 175	86 936	45
16	82 775	95 850	04 150	86 924	44
17	82 788	95 875	04 125	86 913	43
18	82 802	95 901	04 099	86 902	42
19	82 816	95 926	04 074	86 890	41
20	82 830	95 952	04 048	86 879	40
21	82 844	95 977	04 023	86 867	39
22	82 858	96 002	03 998	86 855	38
23	82 872	96 028	03 972	86 844	37
24	82 885	96 053	03 947	86 832	36
25	82 899	96 078	03 922	86 821	35
26	82 913	96 104	03 896	86 809	34
27	82 927	96 129	03 871	86 798	33
28	82 941	96 155	03 845	86 786	32
29	82 955	96 180	03 820	86 775	31
30	82 968	96 205	03 795	86 763	30
31	82 982	96 231	03 769	86 752	29
32	82 996	96 256	03 744	86 740	28
33	83 010	96 281	03 719	86 728	27
34	83 023	96 307	03 693	86 717	26
35	83 037	96 332	03 668	86 705	25
36	83 051	96 357	03 643	86 694	24
37	83 065	96 383	03 617	86 682	23
38	83 078	96 408	03 592	86 670	22
39	83 092	96 433	03 567	86 659	21
40	83 106	96 459	03 541	86 647	20
41	83 120	96 484	03 516	86 635	19
42	83 133	96 510	03 490	86 624	18
43	83 147	96 535	03 465	86 612	17
44	83 161	96 560	03 440	86 600	16
45	83 174	96 586	03 414	86 589	15
46	83 188	96 611	03 389	86 577	14
47	83 202	96 636	03 364	86 565	13
48	83 215	96 662	03 338	86 554	12
49	83 229	96 687	03 313	86 542	11
50	83 242	96 712	03 288	86 530	10
51	83 256	96 738	03 262	86 518	9
52	83 270	96 763	03 237	86 507	8
53	83 283	96 788	03 212	86 495	7
54	83 297	96 814	03 186	86 483	6
55	83 310	96 839	03 161	86 472	5
56	83 324	96 864	03 136	86 460	4
57	83 338	96 890	03 110	86 448	3
58	83 351	96 915	03 085	86 436	2
59	83 365	96 940	03 060	86 425	1
60	83 378	96 966	03 034	86 413	0
	9	9	10	9	
′	log cos	log cot	log tan	log sin	′

43°

′	log sin	log tan	log cot	log cos	′
	9	9	10	9	
0	83 378	96 966	03 034	86 413	60
1	83 392	96 991	03 009	86 401	59
2	83 405	97 016	02 984	86 389	58
3	83 419	97 042	02 958	86 377	57
4	83 432	97 067	02 933	86 366	56
5	83 446	97 092	02 908	86 354	55
6	83 459	97 118	02 882	86 342	54
7	83 473	97 143	02 857	86 330	53
8	83 486	97 168	02 832	86 318	52
9	83 500	97 193	02 807	86 306	51
10	83 513	97 219	02 781	86 295	50
11	83 527	97 244	02 756	86 283	49
12	83 540	97 269	02 731	86 271	48
13	83 554	97 295	02 705	86 259	47
14	83 567	97 320	02 680	86 247	46
15	83 581	97 345	02 655	86 235	45
16	83 594	97 371	02 629	86 223	44
17	83 608	97 396	02 604	86 211	43
18	83 621	97 421	02 579	86 200	42
19	83 634	97 447	02 553	86 188	41
20	83 648	97 472	02 528	86 176	40
21	83 661	97 497	02 503	86 164	39
22	83 674	97 523	02 477	86 152	38
23	83 688	97 548	02 452	86 140	37
24	83 701	97 573	02 427	86 128	36
25	83 715	97 598	02 402	86 116	35
26	83 728	97 624	02 376	86 104	34
27	83 741	97 649	02 351	86 092	33
28	83 755	97 674	02 326	86 080	32
29	83 768	97 700	02 300	86 068	31
30	83 781	97 725	02 275	86 056	30
31	83 795	97 750	02 250	86 044	29
32	83 808	97 776	02 224	86 032	28
33	83 821	97 801	02 199	86 020	27
34	83 834	97 826	02 174	86 008	26
35	83 848	97 851	02 149	85 996	25
36	83 861	97 877	02 123	85 984	24
37	83 874	97 902	02 098	85 972	23
38	83 887	97 927	02 073	85 960	22
39	83 901	97 953	02 047	85 948	21
40	83 914	97 978	02 022	85 936	20
41	83 927	98 003	01 997	85 924	19
42	83 940	98 029	01 971	85 912	18
43	83 954	98 054	01 946	85 900	17
44	83 967	98 079	01 921	85 888	16
45	83 980	98 104	01 896	85 876	15
46	83 993	98 130	01 870	85 864	14
47	84 006	98 155	01 845	85 851	13
48	84 020	98 180	01 820	85 839	12
49	84 033	98 206	01 794	85 827	11
50	84 046	98 231	01 769	85 815	10
51	84 059	98 256	01 744	85 803	9
52	84 072	98 281	01 719	85 791	8
53	84 085	98 307	01 693	85 779	7
54	84 098	98 332	01 668	85 766	6
55	84 112	98 357	01 643	85 754	5
56	84 125	98 383	01 617	85 742	4
57	84 138	98 408	01 592	85 730	3
58	84 151	98 433	01 567	85 718	2
59	84 164	98 458	01 542	85 706	1
60	84 177	98 484	01 516	85 693	0
	9	9	10	9	
′	log cos	log cot	log tan	log sin	′

44°

′	log sin	log tan	log cot	log cos	′
	9	9	10	9	
0	84 177	98 484	01 516	85 693	60
1	84 190	98 509	01 491	85 681	59
2	84 203	98 534	01 466	85 669	58
3	84 216	98 560	01 440	85 657	57
4	84 229	98 585	01 415	85 645	56
5	84 242	98 610	01 390	85 632	55
6	84 255	98 635	01 365	85 620	54
7	84 269	98 661	01 339	85 608	53
8	84 282	98 686	01 314	85 596	52
9	84 295	98 711	01 289	85 583	51
10	84 308	98 737	01 263	85 571	50
11	84 321	98 762	01 238	85 559	49
12	84 334	98 787	01 213	85 547	48
13	84 347	98 812	01 188	85 534	47
14	84 360	98 838	01 162	85 522	46
15	84 373	98 863	01 137	85 510	45
16	84 385	98 888	01 112	85 497	44
17	84 398	98 913	01 087	85 485	43
18	84 411	98 939	01 061	85 473	42
19	84 424	98 964	01 036	85 460	41
20	84 437	98 989	01 011	85 448	40
21	84 450	99 015	00 985	85 436	39
22	84 463	99 040	00 960	85 423	38
23	84 476	99 065	00 935	85 411	37
24	84 489	99 090	00 910	85 399	36
25	84 502	99 116	00 884	85 386	35
26	84 515	99 141	00 859	85 374	34
27	84 528	99 166	00 834	85 361	33
28	84 540	99 191	00 809	85 349	32
29	84 553	99 217	00 783	85 337	31
30	84 566	99 242	00 758	85 324	30
31	84 579	99 267	00 733	85 312	29
32	84 592	99 293	00 707	85 299	28
33	84 605	99 318	00 682	85 287	27
34	84 618	99 343	00 657	85 274	26
35	84 630	99 368	00 632	85 262	25
36	84 643	99 394	00 606	85 250	24
37	84 656	99 419	00 581	85 237	23
38	84 669	99 444	00 556	85 225	22
39	84 682	99 469	00 531	85 212	21
40	84 694	99 495	00 505	85 200	20
41	84 707	99 520	00 480	85 187	19
42	84 720	99 545	00 455	85 175	18
43	84 733	99 570	00 430	85 162	17
44	84 745	99 596	00 404	85 150	16
45	84 758	99 621	00 379	85 137	15
46	84 771	99 646	00 354	85 125	14
47	84 784	99 672	00 328	85 112	13
48	84 796	99 697	00 303	85 100	12
49	84 809	99 722	00 278	85 087	11
50	84 822	99 747	00 253	85 074	10
51	84 835	99 773	00 227	85 062	9
52	84 847	99 798	00 202	85 049	8
53	84 860	99 823	00 177	85 037	7
54	84 873	99 848	00 152	85 024	6
55	84 885	99 874	00 126	85 012	5
56	84 898	99 899	00 101	84 999	4
57	84 911	99 924	00 076	84 986	3
58	84 923	99 949	00 051	84 974	2
59	84 936	99 975	00 025	84 961	1
60	84 949	00 000	00 000	84 949	0
	9	9	10	9	
′	log cos	log cot	log tan	log sin	′

46°

45°

TABLE IV.

FOR DETERMINING WITH GREATER ACCURACY THAN CAN BE DONE BY MEANS OF TABLE III.:

1. *log sin*, *log tan*, and *log cot*, when the angle is between 0° and 2°;
2. *log cos*, *log tan*, and *log cot*, when the angle is between 88° and 90°;
3. The value of the angle when the logarithm of the function does *not* lie between the limits **8. 54 684** and **11. 45 316**.

FORMULAS FOR THE USE OF THE NUMBERS S AND T.

I. When the angle α is between 0° and 2°:

$\log \sin \alpha = \log \alpha'' + S.$
$\log \tan \alpha = \log \alpha'' + T.$
$\log \cot \alpha = \operatorname{colog} \tan \alpha.$

$\log \alpha'' = \log \sin \alpha - S,$
$= \log \tan \alpha - T,$
$= \operatorname{colog} \cot \alpha - T.$

II. When the angle α is between 88° and 90°:

$\log \cos \alpha = \log (90°-\alpha)'' + S.$
$\log \cot \alpha = \log (90°-\alpha)'' + T.$
$\log \tan \alpha = \operatorname{colog} \cot \alpha.$

$\log (90°-\alpha)'' = \log \cos \alpha - S,$
$= \log \cot \alpha - T,$
$= \operatorname{colog} \tan \alpha - T,$
and $\alpha = 90° - (90° - \alpha).$

VALUES OF S AND T.

α''	S	log sin α
0		—
	4. 68 557	
2 409		8. 06 740
	4. 68 556	
3 417		8. 21 920
	4. 68 555	
3 823		8. 26 795
	4. 68 55$\underline{5}$	
4 190		8. 30 776
	4. 68 554	
4 840		8. 37 038
	4. 68 553	
5 414		8. 41 904
	4. 68 552	
5 932		8. 45 872
	4. 68 551	
6 408		8. 49 223
	4. 68 550	
6 633		8. 50 721
	4. 68 5$\underline{5}$0	
6 851		8. 52 125
	4. 68 549	
7 267		8. 54 684
α''	S	log sin α

α''	T	log tan α
0		—
	4. 68 557	
200		6. 98 660
	4. 68 558	
1 726		7. 92 263
	4. 68 559	
2 432		8. 07 156
	4. 68 560	
2 976		8. 15 924
	4. 68 561	
3 434		8. 22 142
	4. 68 562	
3 838		8. 26 973
	4. 68 563	
4 204		8. 30 930
	4. 68 564	
4 540		8. 34 270
	4. 68 56$\underline{5}$	
4 699		8. 35 766
	4. 68 565	
4 853		8. 37 167
	4. 68 566	
5 146		8. 39 713
α''	T	log tan α

α	T	log tan α
5 146		8. 39 713
	4. 68 567	
5 424		8. 41 999
	4. 68 568	
5 689		8. 44 072
	4. 68 569	
5 941		8. 45 955
	4. 68 570	
6 184		8. 47 697
	4. 68 571	
6 417		8. 49 305
	4. 68 572	
6 642		8. 50 802
	4. 68 573	
6 859		8. 52 200
	4. 68 574	
7 070		8. 53 516
	4. 68 57$\underline{5}$	
7 173		8. 54 145
	4. 68 575	
7 274		8. 54 753
α	T	log tan α

TABLE V.

THE NATURAL VALUES
OF
SINES, COSINES, TANGENTS, AND COTANGENTS,
IN THE UNIT CIRCLE.

0°—8°

° ′	sin	tan	cot	cos	′ °
0 0	0.0000	0.0000	infinite	1.0000	0 90
10	0.0029	0.0029	343.7737	1.0000	50
20	0.0058	0.0058	171.8854	1.0000	40
30	0.0087	0.0087	114.5887	1.0000	30
40	0.0116	0.0116	85.9398	0.9999	20
50	0.0145	0.0145	68.7501	0.9999	10
1 0	0.0175	0.0175	57.2900	0.9998	0 89
° ′	cos	cot	tan	sin	′ °

° ′	sin	tan	cot	cos	′ °
1 0	0.0175	0.0175	57.2900	0.9998	0 89
10	0.0204	0.0204	49.1039	0.9998	50
20	0.0233	0.0233	42.9641	0.9997	40
30	0.0262	0.0262	38.1885	0.9997	30
40	0.0291	0.0291	34.3678	0.9996	20
50	0.0320	0.0320	31.2416	0.9995	10
2 0	0.0349	0.0349	28.6363	0.9994	0 88
10	0.0378	0.0378	26.4316	0.9993	50
20	0.0407	0.0407	24.5418	0.9992	40
30	0.0436	0.0437	22.9038	0.9990	30
40	0.0465	0.0466	21.4704	0.9989	20
50	0.0494	0.0495	20.2056	0.9988	10
3 0	0.0523	0.0524	19.0811	0.9986	0 87
10	0.0552	0.0553	18.0750	0.9985	50
20	0.0581	0.0582	17.1693	0.9983	40
30	0.0610	0.0612	16.3499	0.9981	30
40	0.0640	0.0641	15.6048	0.9980	20
50	0.0669	0.0670	14.9244	0.9978	10
4 0	0.0698	0.0699	14.3007	0.9976	0 86
10	0.0727	0.0729	13.7267	0.9974	50
20	0.0756	0.0758	13.1969	0.9971	40
30	0.0785	0.0787	12.7062	0.9969	30
40	0.0814	0.0816	12.2505	0.9967	20
50	0.0843	0.0846	11.8262	0.9964	10
5 0	0.0872	0.0875	11.4301	0.9962	0 85
° ′	cos	cot	tan	sin	′ °

° ′	sin	tan	cot	cos	′ °
5 0	0.0872	0.0875	11.4301	0.9962	0 85
10	0.0901	0.0904	11.0594	0.9959	50
20	0.0929	0.0934	10.7119	0.9957	40
30	0.0958	0.0963	10.3854	0.9954	30
40	0.0987	0.0992	10.0780	0.9951	20
50	0.1016	0.1022	9.7882	0.9948	10
6 0	0.1045	0.1051	9.5144	0.9945	0 84
10	0.1074	0.1080	9.2553	0.9942	50
20	0.1103	0.1110	9.0098	0.9939	40
30	0.1132	0.1139	8.7769	0.9936	30
40	0.1161	0.1169	8.5555	0.9932	20
50	0.1190	0.1198	8.3450	0.9929	10
7 0	0.1219	0.1228	8.1443	0.9925	0 83
10	0.1248	0.1257	7.9530	0.9922	50
20	0.1276	0.1287	7.7704	0.9918	40
30	0.1305	0.1317	7.5958	0.9914	30
40	0.1334	0.1346	7.4287	0.9911	20
50	0.1363	0.1376	7.2687	0.9907	10
8 0	0.1392	0.1405	7.1154	0.9903	0 82
10	0.1421	0.1435	6.9682	0.9899	50
20	0.1449	0.1465	6.8269	0.9894	40
30	0.1478	0.1495	6.6912	0.9890	30
40	0.1507	0.1524	6.5606	0.9886	20
50	0.1536	0.1554	6.4348	0.9881	10
9 0	0.1564	0.1584	6.3138	0.9877	0 81
° ′	cos	cot	tan	sin	′ °

81°—89°

° ′	sin	tan	cot	cos	′ °
9 0	0.1564	0.1584	6.3138	0.9877	0 81
10	0.1593	0.1614	6.1970	0.9872	50
20	0.1622	0.1644	6.0844	0.9868	40
30	0.1650	0.1673	5.9758	0.9863	30
40	0.1679	0.1703	5.8708	0.9858	20
50	0.1708	0.1733	5.7694	0.9853	10
10 0	0.1736	0.1763	5.6713	0.9848	0 80
10	0.1765	0.1793	5.5764	0.9843	50
20	0.1794	0.1823	5.4845	0.9838	40
30	0.1822	0.1853	5.3955	0.9833	30
40	0.1851	0.1883	5.3093	0.9827	20
50	0.1880	0.1914	5.2257	0.9822	10
11 0	0.1908	0.1944	5.1446	0.9816	0 79
10	0.1937	0.1974	5.0658	0.9811	50
20	0.1965	0.2004	4.9894	0.9805	40
30	0.1994	0.2035	4.9152	0.9799	30
40	0.2022	0.2065	4.8430	0.9793	20
50	0.2051	0.2095	4.7729	0.9787	10
12 0	0.2079	0.2126	4.7046	0.9781	0 78
10	0.2108	0.2156	4.6382	0.9775	50
20	0.2136	0.2186	4.5736	0.9769	40
30	0.2164	0.2217	4.5107	0.9763	30
40	0.2193	0.2247	4.4494	0.9757	20
50	0.2221	0.2278	4.3897	0.9750	10
13 0	0.2250	0.2309	4.3315	0.9744	0 77
10	0.2278	0.2339	4.2747	0.9737	50
20	0.2306	0.2370	4.2193	0.9730	40
30	0.2334	0.2401	4.1653	0.9724	30
40	0.2363	0.2432	4.1126	0.9717	20
50	0.2391	0.2462	4.0611	0.9710	10
14 0	0.2419	0.2493	4.0108	0.9703	0 76
10	0.2447	0.2524	3.9617	0.9696	50
20	0.2476	0.2555	3.9136	0.9689	40
30	0.2504	0.2586	3.8667	0.9681	30
40	0.2532	0.2617	3.8208	0.9674	20
50	0.2560	0.2648	3.7760	0.9667	10
15 0	0.2588	0.2679	3.7321	0.9659	0 75
10	0.2616	0.2711	3.6891	0.9652	50
20	0.2644	0.2742	3.6470	0.9644	40
30	0.2672	0.2773	3.6059	0.9636	30
40	0.2700	0.2805	3.5656	0.9628	20
50	0.2728	0.2836	3.5261	0.9621	10
16 0	0.2756	0.2867	3.4874	0.9613	0 74
10	0.2784	0.2899	3.4495	0.9605	50
20	0.2812	0.2931	3.4124	0.9596	40
30	0.2840	0.2962	3.3759	0.9588	30
40	0.2868	0.2994	3.3402	0.9580	20
50	0.2896	0.3026	3.3052	0.9572	10
17 0	0.2924	0.3057	3.2709	0.9563	0 73
10	0.2952	0.3089	3.2371	0.9555	50
20	0.2979	0.3121	3.2041	0.9546	40
30	0.3007	0.3153	3.1716	0.9537	30
40	0.3035	0.3185	3.1397	0.9528	20
50	0.3062	0.3217	3.1084	0.9520	10
18 0	0.3090	0.3249	3.0777	0.9511	0 72

° ′	sin	tan	cot	cos	′ °
18 0	0.3090	0.3249	3.0777	0.9511	0 72
10	0.3118	0.3281	3.0475	0.9502	50
20	0.3145	0.3314	3.0178	0.9492	40
30	0.3173	0.3346	2.9887	0.9483	30
40	0.3201	0.3378	2.9600	0.9474	20
50	0.3228	0.3411	2.9319	0.9465	10
19 0	0.3256	0.3443	2.9042	0.9455	0 71
10	0.3283	0.3476	2.8770	0.9446	50
20	0.3311	0.3508	2.8502	0.9436	40
30	0.3338	0.3541	2.8239	0.9426	30
40	0.3365	0.3574	2.7980	0.9417	20
50	0.3393	0.3607	2.7725	0.9407	10
20 0	0.3420	0.3640	2.7475	0.9397	0 70
10	0.3448	0.3673	2.7228	0.9387	50
20	0.3475	0.3706	2.6985	0.9377	40
30	0.3502	0.3739	2.6746	0.9367	30
40	0.3529	0.3772	2.6511	0.9356	20
50	0.3557	0.3805	2.6279	0.9346	10
21 0	0.3584	0.3839	2.6051	0.9336	0 69
10	0.3611	0.3872	2.5826	0.9325	50
20	0.3638	0.3906	2.5605	0.9315	40
30	0.3665	0.3939	2.5386	0.9304	30
40	0.3692	0.3973	2.5172	0.9293	20
50	0.3719	0.4006	2.4960	0.9283	10
22 0	0.3746	0.4040	2.4751	0.9272	0 68
10	0.3773	0.4074	2.4545	0.9261	50
20	0.3800	0.4108	2.4342	0.9250	40
30	0.3827	0.4142	2.4142	0.9239	30
40	0.3854	0.4176	2.3945	0.9228	20
50	0.3881	0.4210	2.3750	0.9216	10
23 0	0.3907	0.4245	2.3559	0.9205	0 67
10	0.3934	0.4279	2.3369	0.9194	50
20	0.3961	0.4314	2.3183	0.9182	40
30	0.3987	0.4348	2.2998	0.9171	30
40	0.4014	0.4383	2.2817	0.9159	20
50	0.4041	0.4417	2.2637	0.9147	10
24 0	0.4067	0.4452	2.2460	0.9135	0 66
10	0.4094	0.4487	2.2286	0.9124	50
20	0.4120	0.4522	2.2113	0.9112	40
30	0.4147	0.4557	2.1943	0.9100	30
40	0.4173	0.4592	2.1775	0.9088	20
50	0.4200	0.4628	2.1609	0.9075	10
25 0	0.4226	0.4663	2.1445	0.9063	0 65
10	0.4253	0.4699	2.1283	0.9051	50
20	0.4279	0.4734	2.1123	0.9038	40
30	0.4305	0.4770	2.0965	0.9026	30
40	0.4331	0.4806	2.0809	0.9013	20
50	0.4358	0.4841	2.0655	0.9001	10
26 0	0.4384	0.4877	2.0503	0.8988	0 64
10	0.4410	0.4913	2.0353	0.8975	50
20	0.4436	0.4950	2.0204	0.8962	40
30	0.4462	0.4986	2.0057	0.8949	30
40	0.4488	0.5022	1.9912	0.8936	20
50	0.4514	0.5059	1.9768	0.8923	10
27 0	0.4540	0.5095	1.9626	0.8910	0 63

° ′	cos	cot	tan	sin	′ °

° ′	sin	tan	cot	cos	′ °	° ′	sin	tan	cot	cos	′ °
27 0	0.4540	0.5095	1.9626	0.8910	**0 63**	**36 0**	0.5878	0.7265	1.3764	0.8090	**0 54**
10	0.4566	0.5132	1.9486	0.8897	50	10	0.5901	0.7310	1.3680	0.8073	50
20	0.4592	0.5169	1.9347	0.8884	40	20	0.5925	0.7355	1.3597	0.8056	40
30	0.4617	0.5206	1.9210	0.8870	30	30	0.5948	0.7400	1.3514	0.8039	30
40	0.4643	0.5243	1.9074	0.8857	20	40	0.5972	0.7445	1.3432	0.8021	20
50	0.4669	0.5280	1.8940	0.8843	10	50	0.5995	0.7490	1.3351	0.8004	10
28 0	0.4695	0.5317	1.8807	0.8829	**0 62**	**37 0**	0.6018	0.7536	1.3270	0.7986	**0 53**
10	0.4720	0.5354	1.8676	0.8816	50	10	0.6041	0.7581	1.3190	0.7969	50
20	0.4746	0.5392	1.8546	0.8802	40	20	0.6065	0.7627	1.3111	0.7951	40
30	0.4772	0.5430	1.8418	0.8788	30	30	0.6088	0.7673	1.3032	0.7934	30
40	0.4797	0.5467	1.8291	0.8774	20	40	0.6111	0.7720	1.2954	0.7916	20
50	0.4823	0.5505	1.8165	0.8760	10	50	0.6134	0.7766	1.2876	0.7898	10
29 0	0.4848	0.5543	1.8040	0.8746	**0 61**	**38 0**	0.6157	0.7813	1.2799	0.7880	**0 52**
10	0.4874	0.5581	1.7917	0.8732	50	10	0.6180	0.7860	1.2723	0.7862	50
20	0.4899	0.5619	1.7796	0.8718	40	20	0.6202	0.7907	1.2647	0.7844	40
30	0.4924	0.5658	1.7675	0.8704	30	30	0.6225	0.7954	1.2572	0.7826	30
40	0.4950	0.5696	1.7556	0.8689	20	40	0.6248	0.8002	1.2497	0.7808	20
50	0.4975	0.5735	1.7437	0.8675	10	50	0.6271	0.8050	1.2423	0.7790	10
30 0	0.5000	0.5774	1.7321	0.8660	**0 60**	**39 0**	0.6293	0.8098	1.2349	0.7771	**0 51**
10	0.5025	0.5812	1.7205	0.8646	50	10	0.6316	0.8146	1.2276	0.7753	50
20	0.5050	0.5851	1.7090	0.8631	40	20	0.6338	0.8195	1.2203	0.7735	40
30	0.5075	0.5890	1.6977	0.8616	30	30	0.6361	0.8243	1.2131	0.7716	30
40	0.5100	0.5930	1.6864	0.8601	20	40	0.6383	0.8292	1.2059	0.7698	20
50	0.5125	0.5969	1.6753	0.8587	10	50	0.6406	0.8342	1.1988	0.7679	10
31 0	0.5150	0.6000	1.6643	0.8572	**0 59**	**40 0**	0.6428	0.8391	1.1918	0.7660	**0 50**
10	0.5175	0.6048	1.6534	0.8557	50	10	0.6450	0.8441	1.1847	0.7642	50
20	0.5200	0.6088	1.6426	0.8542	40	20	0.6472	0.8491	1.1778	0.7623	40
30	0.5225	0.6128	1.6319	0.8526	30	30	0.6494	0.8541	1.1708	0.7604	30
40	0.5250	0.6168	1.6212	0.8511	20	40	0.6517	0.8591	1.1640	0.7585	20
50	0.5275	0.6208	1.6107	0.8496	10	50	0.6539	0.8642	1.1571	0.7566	10
32 0	0.5299	0.6249	1.6003	0.8480	**0 58**	**41 0**	0.6561	0.8693	1.1504	0.7547	**0 49**
10	0.5324	0.6289	1.5900	0.8465	50	10	0.6583	0.8744	1.1436	0.7528	50
20	0.5348	0.6330	1.5798	0.8450	40	20	0.6604	0.8796	1.1369	0.7509	40
30	0.5373	0.6371	1.5697	0.8434	30	30	0.6626	0.8847	1.1303	0.7490	30
40	0.5398	0.6412	1.5597	0.8418	20	40	0.6648	0.8899	1.1237	0.7470	20
50	0.5422	0.6453	1.5497	0.8403	10	50	0.6670	0.8952	1.1171	0.7451	10
33 0	0.5446	0.6494	1.5399	0.8387	**0 57**	**42 0**	0.6691	0.9004	1.1106	0.7431	**0 48**
10	0.5471	0.6536	1.5301	0.8371	50	10	0.6713	0.9057	1.1041	0.7412	50
20	0.5495	0.6577	1.5204	0.8355	40	20	0.6734	0.9110	1.0977	0.7392	40
30	0.5519	0.6619	1.5108	0.8339	30	30	0.6756	0.9163	1.0913	0.7373	30
40	0.5544	0.6661	1.5013	0.8323	20	40	0.6777	0.9217	1.0850	0.7353	20
50	0.5568	0.6703	1.4919	0.8307	10	50	0.6799	0.9271	1.0786	0.7333	10
34 0	0.5592	0.6745	1.4826	0.8290	**0 56**	**43 0**	0.6820	0.9325	1.0724	0.7314	**0 47**
10	0.5616	0.6787	1.4733	0.8274	50	10	0.6841	0.9380	1.0661	0.7294	50
20	0.5640	0.6830	1.4641	0.8258	40	20	0.6862	0.9435	1.0599	0.7274	40
30	0.5664	0.6873	1.4550	0.8241	30	30	0.6884	0.9490	1.0538	0.7254	30
40	0.5688	0.6916	1.4460	0.8225	20	40	0.6905	0.9545	1.0477	0.7234	20
50	0.5712	0.6959	1.4370	0.8208	10	50	0.6926	0.9601	1.0416	0.7214	10
35 0	0.5736	0.7002	1.4281	0.8192	**0 55**	**44 0**	0.6947	0.9657	1.0355	0.7193	**0 46**
10	0.5760	0.7046	1.4193	0.8175	50	10	0.6967	0.9713	1.0295	0.7173	50
20	0.5783	0.7089	1.4106	0.8158	40	20	0.6988	0.9770	1.0235	0.7153	40
30	0.5807	0.7133	1.4019	0.8141	30	30	0.7009	0.9827	1.0176	0.7133	30
40	0.5831	0.7177	1.3934	0.8124	20	40	0.7030	0.9884	1.0117	0.7112	20
50	0.5854	0.7221	1.3848	0.8107	10	50	0.7050	0.9942	1.0058	0.7092	10
36 0	0.5878	0.7265	1.3764	0.8090	**0 54**	**45 0**	0.7071	1.0000	1.0000	0.7071	**0 45**
° ′	cos	cot	tan	sin	′ °	° ′	cos	cot	tan	sin	′ °

TABLE VI. — CIRCUMFERENCES AND AREAS OF CIRCLES.

If N = the radius of the circle, the circumference $= 2\pi N$.

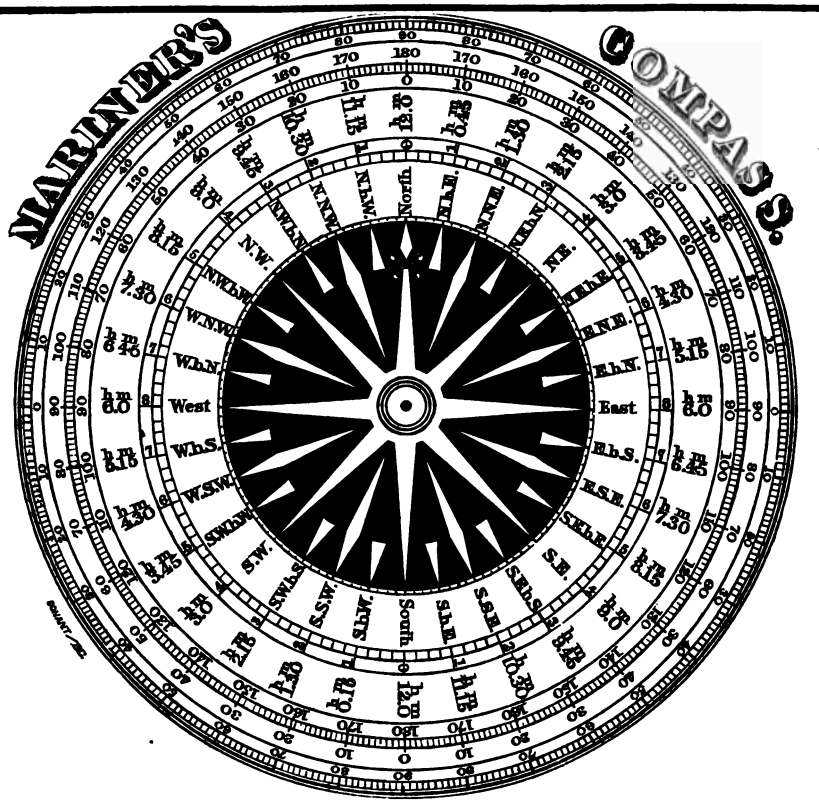
If N = the radius of the circle, the area $= \pi N^2$.

If N = the circumference of the circle, the radius $= \frac{1}{2\pi} N$.

If N = the circumference of the circle, the area $= \frac{1}{4\pi} N^2$.

N	$2\pi N$	πN^2	$\frac{1}{2\pi} N$	$\frac{1}{4\pi} N^2$	N	$2\pi N$	πN^2	$\frac{1}{2\pi} N$	$\frac{1}{4\pi} N^2$
0	0.00	0.0	0.000	0.00	50	314.16	7 854	7.96	198.94
1	6.28	3.1	0.159	0.08	51	320.44	8 171	8.12	206.98
2	12.57	12.6	0.318	0.32	52	326.73	8 495	8.28	215.18
3	18.85	28.3	0.477	0.72	53	333.01	8 825	8.44	223.53
4	25.13	50.3	0.637	1.27	54	339.29	9 161	8.59	232.05
5	31.42	78.5	0.796	1.99	55	345.58	9 503	8.75	240.72
6	37.70	113.1	0.955	2.86	56	351.86	9 852	8.91	249.55
7	43.98	153.9	1.114	3.90	57	358.14	10 207	9.07	258.55
8	50.27	201.1	1.273	5.09	58	364.42	10 568	9.23	267.70
9	56.55	254.5	1.432	6.45	59	370.71	10 936	9.39	277.01
10	62.83	314.2	1.592	7.96	60	376.99	11 310	9.55	286.48
11	69.12	380.1	1.751	9.63	61	383.27	11 690	9.71	296.11
12	75.40	452.4	1.910	11.46	62	389.56	12 076	9.87	305.90
13	81.68	530.9	2.069	13.45	63	395.84	12 469	10.03	315.84
14	87.96	615.8	2.228	15.60	64	402.12	12 868	10.19	325.95
15	94.25	706.9	2.387	17.90	65	408.41	13 273	10.35	336.21
16	100.53	804.2	2.546	20.37	66	414.69	13 685	10.50	346.64
17	106.81	907.9	2.706	23.00	67	420.97	14 103	10.66	357.22
18	113.10	1 017.9	2.865	25.78	68	427.26	14 527	10.82	367.97
19	119.38	1 134.1	3.024	28.73	69	433.54	14 957	10.98	378.87
20	125.66	1 256.6	3.183	31.83	70	439.82	15 394	11.14	389.93
21	131.95	1 385.4	3.342	35.09	71	446.11	15 837	11.30	401.15
22	138.23	1 520.5	3.501	38.52	72	452.39	16 286	11.46	412.53
23	144.51	1 661.9	3.661	42.10	73	458.67	16 742	11.62	424.07
24	150.80	1 809.6	3.820	45.84	74	464.96	17 203	11.78	435.77
25	157.08	1 963.5	3.979	49.74	75	471.24	17 671	11.94	447.62
26	163.36	2 123.7	4.138	53.79	76	477.52	18 146	12.10	459.64
27	169.65	2 290.2	4.297	58.01	77	483.81	18 627	12.25	471.81
28	175.93	2 463.0	4.456	62.39	78	490.09	19 113	12.41	484.15
29	182.21	2 642.1	4.615	66.92	79	496.37	19 607	12.57	496.64
30	188.50	2 827.4	4.775	71.62	80	502.65	20 106	12.73	509.30
31	194.78	3 019.1	4.934	76.47	81	508.94	20 612	12.89	522.11
32	201.06	3 217.0	5.093	81.49	82	515.22	21 124	13.05	535.08
33	207.35	3 421.2	5.252	86.66	83	521.50	21 642	13.21	548.21
34	213.63	3 631.7	5.411	91.99	84	527.79	22 167	13.37	561.50
35	219.91	3 848.5	5.570	97.48	85	534.07	22 698	13.53	574.95
36	226.19	4 071.5	5.730	103.13	86	540.35	23 235	13.69	588.55
37	232.48	4 300.8	5.889	108.94	87	546.64	23 779	13.85	602.32
38	238.76	4 536.5	6.048	114.91	88	552.92	24 328	14.01	616.25
39	245.04	4 778.4	6.207	121.04	89	559.20	24 885	14.16	630.33
40	251.33	5 026.5	6.366	127.32	90	565.49	25 447	14.32	644.58
41	257.61	5 281.0	6.525	133.77	91	571.77	26 016	14.48	658.98
42	263.89	5 541.8	6.685	140.37	92	578.05	26 590	14.64	673.54
43	270.18	5 808.8	6.844	147.14	93	584.34	27 172	14.80	688.27
44	276.46	6 082.1	7.003	154.06	94	590.62	27 759	14.96	703.15
45	282.74	6 361.7	7.162	161.14	95	596.90	28 353	15.12	718.19
46	289.03	6 647.6	7.321	168.39	96	603.19	28 953	15.28	733.39
47	295.31	6 939.8	7.480	175.79	97	609.47	29 559	15.44	748.74
48	301.59	7 238.2	7.639	183.35	98	615.75	30 172	15.60	764.26
49	307.88	7 543.0	7.799	191.07	99	622.04	30 791	15.76	779.94
50	314.16	7 854.0	7.958	198.94	100	628.32	31 416	15.92	795.77

N	$2\pi N$	πN^2	$\frac{1}{2\pi} N$	$\frac{1}{4\pi} N^2$	N	$2\pi N$	πN^2	$\frac{1}{2\pi} N$	$\frac{1}{4\pi} N^2$



A TABLE OF THE ANGLES

Which every Point and Quarter Point of the Compass makes with the Meridian.

North.		Points.	° ′ ″	Points.	South.	
		0 - 1/4	2 48 45	0 - 1/4		
		0 - 1/2	5 37 30	0 - 1/2		
		0 - 3/4	8 26 15	0 - 3/4		
N. by E.	N. by W.	1	11 15 0	1	S. by E.	S. by W.
		1 - 1/4	14 3 45	1 - 1/4		
		1 - 1/2	16 52 30	1 - 1/2		
		1 - 3/4	19 41 15	1 - 3/4		
N.N.E.	N.N.W.	2	22 30 0	2	S.S.E.	S.S.W.
		2 - 1/4	25 18 45	2 - 1/4		
		2 - 1/2	28 7 30	2 - 1/2		
		2 - 3/4	30 56 15	2 - 3/4		
N.E. by N.	N.W. by N.	3	33 45 0	3	S.E. by S.	S.W. by S.
		3 - 1/4	36 33 45	3 - 1/4		
		3 - 1/2	39 22 30	3 - 1/2		
		3 - 3/4	42 11 15	3 - 3/4		
N.E.	N.W.	4	45 0 0	4	S.E.	S.W.
		4 - 1/4	47 48 45	4 - 1/4		
		4 - 1/2	50 37 30	4 - 1/2		
		4 - 3/4	53 26 15	4 - 3/4		
N.E. by E.	N.W. by W.	5	56 15 0	5	S.E. by E.	S.W. by W.
		5 - 1/4	59 3 45	5 - 1/4		
		5 - 1/2	61 52 30	5 - 1/2		
		5 - 3/4	64 41 15	5 - 3/4		
E.N.E.	W.N.W.	6	67 30 0	6	E.S.E.	W.S.W.
		6 - 1/4	70 18 45	6 - 1/4		
		6 - 1/2	73 7 30	6 - 1/2		
		6 - 3/4	75 56 15	6 - 3/4		
E. by N.	W. by N.	7	78 45 0	7	E. by S.	W. by S.
		7 - 1/4	81 33 45	7 - 1/4		
		7 - 1/2	84 22 30	7 - 1/2		
		7 - 3/4	87 11 15	7 - 3/4		
East.	West.	8	90 0 0	8	East.	West.

TABLE VII.—TRAVERSE TABLE.

Bearing.	Distance 1.		Distance 2.		Distance 3.		Distance 4.		Distance 5.		Bearing.
° ′	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	° ′
0 15	1.000	0.004	2.000	0.009	3.000	0.013	4.000	0.017	5.000	0.022	89 45
30	1.000	0.009	2.000	0.017	3.000	0.026	4.000	0.035	5.000	0.044	30
45	1.000	0.013	2.000	0.026	3.000	0.039	4.000	0.052	5.000	0.065	15
1 0	1.000	0.017	2.000	0.035	3.000	0.052	3.999	0.070	4.999	0.087	89 0
15	1.000	0.022	2.000	0.044	2.999	0.065	3.999	0.087	4.999	0.109	45
30	1.000	0.026	1.999	0.052	2.999	0.079	3.999	0.105	4.998	0.131	30
45	1.000	0.031	1.999	0.061	2.999	0.092	3.998	0.122	4.998	0.153	15
2 0	0.999	0.035	1.999	0.070	2.998	0.105	3.998	0.140	4.997	0.174	88 0
15	0.999	0.039	1.998	0.079	2.998	0.118	3.997	0.157	4.996	0.196	45
30	0.999	0.044	1.998	0.087	2.997	0.131	3.996	0.174	4.995	0.218	30
45	0.999	0.048	1.998	0.096	2.997	0.144	3.995	0.192	4.994	0.240	15
3 0	0.999	0.052	1.997	0.105	2.996	0.157	3.995	0.209	4.993	0.262	87 0
15	0.998	0.057	1.997	0.113	2.995	0.170	3.994	0.227	4.992	0.283	45
30	0.998	0.061	1.996	0.122	2.994	0.183	3.993	0.244	4.991	0.305	30
45	0.998	0.065	1.996	0.131	2.994	0.196	3.991	0.262	4.989	0.327	15
4 0	0.998	0.070	1.995	0.140	2.993	0.209	3.990	0.279	4.988	0.349	86 0
15	0.997	0.074	1.995	0.148	2.992	0.222	3.989	0.296	4.986	0.371	45
30	0.997	0.078	1.994	0.157	2.991	0.235	3.988	0.314	4.985	0.392	30
45	0.997	0.083	1.993	0.166	2.990	0.248	3.986	0.331	4.983	0.414	15
5 0	0.996	0.087	1.992	0.174	2.989	0.261	3.985	0.349	4.981	0.436	85 0
15	0.996	0.092	1.992	0.183	2.987	0.275	3.983	0.366	4.979	0.458	45
30	0.995	0.096	1.991	0.192	2.986	0.288	3.982	0.383	4.977	0.479	30
45	0.995	0.100	1.990	0.200	2.985	0.301	3.980	0.401	4.975	0.501	15
6 0	0.995	0.105	1.989	0.209	2.984	0.314	3.978	0.418	4.973	0.523	84 0
15	0.994	0.109	1.988	0.218	2.982	0.327	3.976	0.435	4.970	0.544	45
30	0.994	0.113	1.987	0.226	2.981	0.340	3.974	0.453	4.968	0 566	30
45	0.993	0.118	1.986	0.235	2.979	0.353	3.972	0.470	4.965	0.588	15
7 0	0.993	0.122	1.985	0.244	2.978	0.366	3.970	0.487	4.963	0.609	83 0
15	0.992	0.126	1.984	0.252	2.976	0.379	3.968	0.505	4.960	0.631	45
30	0.991	0.131	1.983	0.261	2.974	0.392	3.966	0.522	4.957	0.653	30
45	0.991	0.135	1.982	0.270	2.973	0.405	3.963	0.539	4.954	0.674	15
8 0	0.990	0.139	1.981	0.278	2.971	0.418	3.961	0.557	4.951	0.696	82 0
15	0.990	0.143	1.979	0.287	2.969	0.430	3.959	0.574	4.948	0.717	45
30	0.989	0.148	1.978	0.296	2.967	0.443	3.956	0.591	4.945	0.739	30
45	0.988	0.152	1.977	0.304	2.965	0.456	3.953	0.608	4.942	0.761	15
9 0	0.988	0.156	1.975	0.313	2.963	0.469	3.951	0.626	4.938	0.782	81 0
15	0.987	0.161	1.974	0.321	2.961	0.482	3.948	0.643	4.935	0.804	45
30	0.986	0.165	1.973	0.330	2.959	0.495	3.945	0.660	4.931	0.825	30
45	0.986	0.169	1.971	0.339	2.957	0.508	3.942	0.677	4.928	0.847	15
10 0	0.985	0.174	1.970	0.347	2.954	0.521	3.939	0.695	4.924	0.868	80 0
15	0.984	0.178	1.968	0.356	2.952	0.534	3.936	0.712	4.920	0.890	45
30	0.983	0.182	1.967	0.364	2.950	0.547	3.933	0.729	4.916	0.911	30
45	0.982	0.187	1.965	0.373	2.947	0.560	3.930	0.746	4.912	0.933	15
11 0	0.982	0.191	1.963	0.382	2.945	0.572	3.927	0.763	4.908	0.954	79 0
15	0.981	0.195	1.962	0.390	2.942	0.585	3.923	0.780	4.904	0.975	45
30	0.980	0.199	1.960	0.399	2.940	0.598	3.920	0.797	4.900	0.997	30
45	0.979	0.204	1.958	0.407	2.937	0.611	3.916	0.815	4.895	1.018	15
12 0	0.978	0.208	1.956	0.416	2.934	0.624	3.913	0.832	4.891	1.040	78 0
15	0.977	0.212	1.954	0.424	2.932	0.637	3.909	0.849	4.886	1.061	45
30	0.976	0.216	1.953	0.433	2.929	0.649	3.905	0.866	4.881	1.082	30
45	0.975	0.221	1.951	0.441	2.926	0.662	3.901	0.883	4.877	1.103	15
13 0	0.974	0.225	1.949	0.450	2.923	0.675	3.897	0.900	4.872	1.125	77 0
15	0.973	0.229	1.947	0.458	2.920	0.688	3.894	0.917	4.867	1.146	45
30	0.972	0.233	1.945	0.467	2.917	0.700	3.889	0.934	4.862	1.167	30
45	0.971	0.238	1.943	0.475	2.914	0.713	3.885	0.951	4.857	1.188	15
14 0	0.970	0.242	1.941	0.484	2.911	0.726	3.881	0.968	4.851	1.210	76 0
15	0.969	0.246	1.938	0.492	2.908	0.738	3.877	0.985	4.846	1.231	45
30	0.968	0.250	1.936	0.501	2.904	0.751	3.873	1.002	4.841	1.252	30
45	0.967	0.255	1.934	0.509	2.901	0.764	3.868	1.018	4.835	1.273	15
15 0	0.966	0.259	1.932	0.518	2.898	0.776	3.864	1.035	4.830	1.294	75 0
° ′	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	° ′
Bearing.	Distance 1.		Distance 2.		Distance 3.		Distance 4.		Distance 5.		Bearing.

Bearing.	Distance 6.		Distance 7.		Distance 8.		Distance 9.		Distance 10.		Bearing.
° ′	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	° ′
0 15	6.000	0.026	7.000	0.031	8.000	0.035	9.000	0.039	10.000	0.044	89 45
30	6.000	0.052	7.000	0.061	8.000	0.070	9.000	0.079	10.000	0.087	30
45	5.999	0.079	6.999	0.092	7.999	0.105	8.999	0.118	9.999	0.131	15
1 0	5.999	0.105	6.999	0.122	7.999	0.140	8.999	0.157	9.999	0.175	89 0
15	5.999	0.131	6.998	0.153	7.998	0.175	8.998	0.196	9.998	0.218	45
30	5.998	0.157	6.998	0.183	7.997	0.209	8.997	0.236	9.997	0.262	30
45	5.997	0.183	6.997	0.214	7.996	0.244	8.996	0.275	9.995	0.305	15
2 0	5.996	0.209	6.996	0.244	7.995	0.279	8.995	0.314	9.994	0.349	88 0
15	5.995	0.236	6.995	0.275	7.994	0.314	8.993	0.353	9.992	0.393	45
30	5.994	0.262	6.993	0.305	7.992	0.349	8.991	0.393	9.991	0.436	30
45	5.993	0.288	6.992	0.336	7.991	0.384	8.990	0.432	9.989	0.480	15
3 0	5.992	0.314	6.990	0.366	7.989	0.419	8.988	0.471	9.986	0.523	87 0
15	5.990	0.340	6.989	0.397	7.987	0.454	8.986	0.510	9.984	0.567	45
30	5.989	0.366	6.987	0.427	7.985	0.488	8.983	0.549	9.981	0.611	30
45	5.987	0.392	6.985	0.458	7.983	0.523	8.981	0.589	9.979	0.654	15
4 0	5.985	0.419	6.983	0.488	7.981	0.558	8.978	0.628	9.976	0.698	86 0
15	5.984	0.445	6.981	0.519	7.978	0.593	8.975	0.667	9.973	0.741	45
30	5.982	0.471	6.978	0.549	7.975	0.628	8.972	0.706	9.969	0.785	30
45	5.979	0.497	6.976	0.580	7.973	0.662	8.969	0.745	9.966	0.828	15
5 0	5.977	0.523	6.973	0.610	7.970	0.697	8.966	0.784	9.962	0.872	85 0
15	5.975	0.549	6.971	0.641	7.966	0.732	8.962	0.824	9.958	0.915	45
30	5.972	0.575	6.968	0.671	7.963	0.767	8.959	0.863	9.954	0.959	30
45	5.970	0.601	6.965	0.701	7.960	0.802	8.955	0.902	9.950	1.002	15
6 0	5.967	0.627	6.962	0.732	7.956	0.836	8.951	0.941	9.945	1.045	84 0
15	5.964	0.653	6.958	0.762	7.952	0.871	8.947	0.980	9.941	1.089	45
30	5.961	0.679	6.955	0.792	7.949	0.906	8.942	1.019	9.936	1.132	30
45	5.958	0.705	6.951	0.823	7.945	0.940	8.938	1.058	9.931	1.175	15
7 0	5.955	0.731	6.948	0.853	7.940	0.975	8.933	1.097	9.926	1.219	83 0
15	5.952	0.757	6.944	0.883	7.936	1.010	8.928	1.136	9.920	1.262	45
30	5.949	0.783	6.940	0.914	7.932	1.044	8.923	1.175	9.914	1.305	30
45	5.945	0.809	6.936	0.944	7.927	1.079	8.918	1.214	9.909	1.349	15
8 0	5.942	0.835	6.932	0.974	7.922	1.113	8.912	1.253	9.903	1.392	82 0
15	5.938	0.861	6.928	1.004	7.917	1.148	8.907	1.291	9.897	1.435	45
30	5.934	0.887	6.923	1.035	7.912	1.182	8.901	1.330	9.890	1.478	30
45	5.930	0.913	6.919	1.065	7.907	1.217	8.895	1.369	9.884	1.521	15
9 0	5.926	0.939	6.914	1.095	7.902	1.251	8.889	1.408	9.877	1.564	81 0
15	5.922	0.964	6.909	1.125	7.896	1.286	8.883	1.447	9.870	1.607	45
30	5.918	0.990	6.904	1.155	7.890	1.320	8.877	1.485	9.863	1.651	30
45	5.913	1.016	6.899	1.185	7.884	1.355	8.870	1.524	9.856	1.694	15
10 0	5.909	1.042	6.894	1.216	7.878	1.389	8.863	1.563	9.848	1.737	80 0
15	5.904	1.068	6.888	1.246	7.872	1.424	8.856	1.601	9.840	1.779	45
30	5.900	1.093	6.883	1.276	7.866	1.458	8.849	1.640	9.833	1.822	30
45	5.895	1.119	6.877	1.306	7.860	1.492	8.842	1.679	9.825	1.865	15
11 0	5.890	1.145	6.871	1.336	7.853	1.526	8.835	1.717	9.816	1.908	79 0
15	5.885	1.171	6.866	1.366	7.846	1.561	8.827	1.756	9.808	1.951	45
30	5.880	1.196	6.859	1.396	7.839	1.595	8.819	1.794	9.799	1.994	30
45	5.874	1.222	6.853	1.425	7.832	1.629	8.811	1.833	9.791	2.036	15
12 0	5.869	1.247	6.847	1.455	7.825	1.663	8.803	1.871	9.782	2.079	78 0
15	5.863	1.273	6.841	1.485	7.818	1.697	8.795	1.910	9.772	2.122	45
30	5.858	1.299	6.834	1.515	7.810	1.732	8.787	1.948	9.763	2.164	30
45	5.852	1.324	6.827	1.545	7.803	1.766	8.778	1.986	9.753	2.207	15
13 0	5.846	1.350	6.821	1.575	7.795	1.800	8.769	2.025	9.744	2.250	77 0
15	5.840	1.375	6.814	1.604	7.787	1.834	8.760	2.063	9.734	2.292	45
30	5.834	1.401	6.807	1.634	7.779	1.868	8.751	2.101	9.724	2.335	30
45	5.828	1.426	6.799	1.664	7.771	1.902	8.742	2.139	9.713	2.377	15
14 0	5.822	1.452	6.792	1.693	7.762	1.935	8.733	2.177	9.703	2.419	76 0
15	5.815	1.477	6.785	1.723	7.754	1.969	8.723	2.215	9.692	2.462	45
30	5.809	1.502	6.777	1.753	7.745	2.003	8.713	2.253	9.682	2.504	30
45	5.802	1.528	6.769	1.782	7.736	2.037	8.703	2.291	9.671	2.546	15
15 0	5.796	1.553	6.761	1.812	7.727	2.071	8.693	2.329	9.659	2.588	75 0
° ′	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	° ′
Bearing.	Distance 6.		Distance 7.		Distance 8.		Distance 9.		Distance 10.		Bearing.

15° — 30°

Bearing.	Distance 1.		Distance 2.		Distance 3.		Distance 4.		Distance 5.		Bearing.
° ′	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	° ′
15 15	0.965	0.263	1.930	0.526	2.894	0.789	3.859	1.052	4.824	1.315	74 45
30	0.964	0.267	1.927	0.534	2.891	0.802	3.855	1.069	4.818	1.336	30
45	0.962	0.271	1.925	0.543	2.887	0.814	3.850	1.086	4.812	1.357	15
16 0	0.961	0.276	1.923	0.551	2.884	0.827	3.845	1.103	4.806	1.378	74 0
15	0.960	0.280	1.920	0.560	2.880	0.839	3.840	1.119	4.800	1.399	45
30	0.959	0.284	1.918	0.568	2.876	0.852	3.835	1.136	4.794	1.420	30
45	0.958	0.288	1.915	0.576	2.873	0.865	3.830	1.153	4.788	1.441	15
17 0	0.956	0.292	1.913	0.585	2.869	0.877	3.825	1.169	4.782	1.462	73 0
15	0.955	0.297	1.910	0.593	2.865	0.890	3.820	1.186	4.775	1.483	45
30	0.954	0.301	1.907	0.601	2.861	0.902	3.815	1.203	4.769	1.504	30
45	0.952	0.305	1.905	0.610	2.857	0.915	3.810	1.220	4.762	1.524	15
18 0	0.951	0.309	1.902	0.618	2.853	0.927	3.804	1.236	4.755	1.545	72 0
15	0.950	0.313	1.899	0.626	2.849	0.939	3.799	1.253	4.748	1.566	45
30	0.948	0.317	1.897	0.635	2.845	0.952	3.793	1.269	4.742	1.587	30
45	0.947	0.321	1.894	0.643	2.841	0.964	3.788	1.286	4.735	1.607	15
19 0	0.946	0.326	1.891	0.651	2.837	0.977	3.782	1.302	4.728	1.628	71 0
15	0.944	0.330	1.888	0.659	2.832	0.989	3.776	1.319	4.720	1.648	45
30	0.943	0.334	1.885	0.668	2.828	1.001	3.771	1.335	4.713	1.669	30
45	0.941	0.338	1.882	0.676	2.824	1.014	3.765	1.352	4.706	1.690	15
20 0	0.940	0.342	1.879	0.684	2.819	1.026	3.759	1.368	4.698	1.710	70 0
15	0.938	0.346	1.876	0.692	2.815	1.038	3.753	1.384	4.691	1.731	45
30	0.937	0.350	1.873	0.700	2.810	1.051	3.747	1.401	4.683	1.751	30
45	0.935	0.354	1.870	0.709	2.805	1.063	3.741	1.417	4.676	1.771	15
21 0	0.934	0.358	1.867	0.717	2.801	1.075	3.734	1.433	4.668	1.792	69 0
15	0.932	0.362	1.864	0.725	2.796	1.087	3.728	1.450	4.660	1.812	45
30	0.930	0.367	1.861	0.733	2.791	1.100	3.722	1.466	4.652	1.833	30
45	0.929	0.371	1.858	0.741	2.786	1.112	3.715	1.482	4.644	1.853	15
22 0	0.927	0.375	1.854	0.749	2.782	1.124	3.709	1.498	4.636	1.873	68 0
15	0.926	0.379	1.851	0.757	2.777	1.136	3.702	1.515	4.628	1.893	45
30	0.924	0.383	1.848	0.765	2.772	1.148	3.696	1.531	4.619	1.913	30
45	0.922	0.387	1.844	0.773	2.767	1.160	3.689	1.547	4.611	1.934	15
23 0	0.921	0.391	1.841	0.781	2.762	1.172	3.682	1.563	4.603	1.954	67 0
15	0.919	0.395	1.838	0.789	2.756	1.184	3.675	1.579	4.594	1.974	45
30	0.917	0.399	1.834	0.797	2.751	1.196	3.668	1.595	4.585	1.994	30
45	0.915	0.403	1.831	0.805	2.746	1.208	3.661	1.611	4.577	2.014	15
24 0	0.914	0.407	1.827	0.813	2.741	1.220	3.654	1.627	4.568	2.034	66 0
15	0.912	0.411	1.824	0.821	2.735	1.232	3.647	1.643	4.559	2.054	45
30	0.910	0.415	1.820	0.829	2.730	1.244	3.640	1.659	4.550	2.073	30
45	0.908	0.419	1.816	0.837	2.724	1.256	3.633	1.675	4.541	2.093	15
25 0	0.906	0.423	1.813	0.845	2.719	1.268	3.625	1.690	4.532	2.113	65 0
15	0.904	0.427	1.809	0.853	2.713	1.280	3.618	1.706	4.522	2.133	45
30	0.903	0.431	1.805	0.861	2.708	1.292	3.610	1.722	4.513	2.153	30
45	0.901	0.434	1.801	0.869	2.702	1.303	3.603	1.738	4.503	2.172	15
26 0	0.899	0.438	1.798	0.877	2.696	1.315	3.595	1.753	4.494	2.192	64 0
15	0.897	0.442	1.794	0.885	2.691	1.327	3.587	1.769	4.484	2.211	45
30	0.895	0.446	1.790	0.892	2.685	1.339	3.580	1.785	4.475	2.231	30
45	0.893	0.450	1.786	0.900	2.679	1.350	3.572	1.800	4.465	2.250	15
27 0	0.891	0.454	1.782	0.908	2.673	1.362	3.564	1.816	4.455	2.270	63 0
15	0.889	0.458	1.778	0.916	2.667	1.374	3.556	1.831	4.445	2.289	45
30	0.887	0.462	1.774	0.923	2.661	1.385	3.548	1.847	4.435	2.309	30
45	0.885	0.466	1.770	0.931	2.655	1.397	3.540	1.862	4.425	2.328	15
28 0	0.883	0.469	1.766	0.939	2.649	1.408	3.532	1.878	4.415	2.347	62 0
15	0.881	0.473	1.762	0.947	2.643	1.420	3.524	1.893	4.404	2.367	45
30	0.879	0.477	1.758	0.954	2.636	1.431	3.515	1.909	4.394	2.386	30
45	0.877	0.481	1.753	0.962	2.630	1.443	3.507	1.924	4.384	2.405	15
29 0	0.875	0.485	1.749	0.970	2.624	1.454	3.498	1.939	4.373	2.424	61 0
15	0.872	0.489	1.745	0.977	2.617	1.466	3.490	1.954	4.362	2.443	45
30	0.870	0.492	1.741	0.985	2.611	1.477	3.481	1.970	4.352	2.462	30
45	0.868	0.496	1.736	0.992	2.605	1.489	3.473	1.985	4.341	2.481	15
30 0	0.866	0.500	1.732	1.000	2.598	1.500	3.464	2.000	4.330	2.500	60 0
° ′	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	° ′
Bearing.	Distance 1.		Distance 2.		Distance 3.		Distance 4.		Distance 5.		Bearing.

60° — 75°

Bearing.	Distance 6.		Distance 7.		Distance 8.		Distance 9.		Distance 10.		Bearing.
° ′	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	° ′
15 15	5.789	1.578	6.754	1.841	7.718	2.104	8.683	2.367	9.648	2.630	74 45
30	5.782	1.603	6.745	1.871	7.709	2.138	8.673	2.405	9.636	2.672	30
45	5.775	1.629	6.737	1.900	7.700	2.172	8.662	2.443	9.625	2.714	15
16 0	5.768	1.654	6.729	1.929	7.690	2.205	8.651	2.481	9.613	2.756	74 0
15	5.760	1.679	6.720	1.959	7.680	2.239	8.640	2.518	9.601	2.798	45
30	5.753	1.704	6.712	1.988	7.671	2.272	8.629	2.556	9.588	2.840	30
45	5.745	1.729	6.703	2.017	7.661	2.306	8.618	2.594	9.576	2.882	15
17 0	5.738	1.754	6.694	2.047	7.650	2.339	8.607	2.631	9.563	2.924	73 0
15	5.730	1.779	6.685	2.076	7.640	2.372	8.595	2.669	9.550	2.965	45
30	5.722	1.804	6.676	2.105	7.630	2.406	8.583	2.706	9.537	3.007	30
45	5.714	1.829	6.667	2.134	7.619	2.439	8.572	2.744	9.524	3.049	15
18 0	5.706	1.854	6.657	2.163	7.608	2.472	8.560	2.781	9.511	3.090	72 0
15	5.698	1.879	6.648	2.192	7.598	2.505	8.547	2.818	9.497	3.132	45
30	5.690	1.904	6.638	2.221	7.587	2.538	8.535	2.856	9.483	3.173	30
45	5.682	1.929	6.629	2.250	7.575	2.572	8.522	2.893	9.469	3.214	15
19 0	5.673	1.953	6.619	2.279	7.564	2.605	8.510	2.930	9.455	3.256	71 0
15	5.665	1.978	6.609	2.308	7.553	2.638	8.497	2.967	9.441	3.297	45
30	5.656	2.003	6.598	2.337	7.541	2.670	8.484	3.004	9.426	3.338	30
45	5.647	2.028	6.588	2.365	7.529	2.703	8.471	3.041	9.412	3.379	15
20 0	5.638	2.052	6.578	2.394	7.518	2.736	8.457	3.078	9.397	3.420	70 0
15	5.629	2.077	6.567	2.423	7.506	2.769	8.444	3.115	9.382	3.461	45
30	5.620	2.101	6.557	2.451	7.493	2.802	8.430	3.152	9.367	3.502	30
45	5.611	2.126	6.546	2.480	7.481	2.834	8.416	3.189	9.351	3.543	15
21 0	5.601	2.150	6.535	2.509	7.469	2.867	8.402	3.225	9.336	3.584	69 0
15	5.592	2.175	6.524	2.537	7.456	2.900	8.388	3.262	9.320	3.624	45
30	5.582	2.199	6.513	2.566	7.443	2.932	8.374	3.299	9.304	3.665	30
45	5.573	2.223	6.502	2.594	7.430	2.964	8.359	3.335	9.288	3.706	15
22 0	5.563	2.248	6.490	2.622	7.417	2.997	8.345	3.371	9.272	3.746	68 0
15	5.553	2.272	6.479	2.651	7.404	3.029	8.330	3.408	9.255	3.787	45
30	5.543	2.296	6.467	2.679	7.391	3.061	8.315	3.444	9.239	3.827	30
45	5.533	2.320	6.455	2.707	7.378	3.094	8.300	3.480	9.222	3.867	15
23 0	5.523	2.344	6.444	2.735	7.364	3.126	8.285	3.517	9.205	3.907	67 0
15	5.513	2.368	6.432	2.763	7.350	3.158	8.269	3.553	9.188	3.947	45
30	5.502	2.392	6.419	2.791	7.336	3.190	8.254	3.589	9.171	3.988	30
45	5.492	2.416	6.407	2.819	7.322	3.222	8.238	3.625	9.153	4.028	15
24 0	5.481	2.440	6.395	2.847	7.308	3.254	8.222	3.661	9.136	4.067	66 0
15	5.471	2.464	6.382	2.875	7.294	3.286	8.206	3.696	9.118	4.107	45
30	5.460	2.488	6.370	2.903	7.280	3.318	8.190	3.732	9.100	4.147	30
45	5.449	2.512	6.357	2.931	7.265	3.349	8.173	3.768	9.081	4.187	15
25 0	5.438	2.536	6.344	2.958	7.250	3.381	8.157	3.804	9.063	4.226	65 0
15	5.427	2.559	6.331	2.986	7.236	3.413	8.140	3.839	9.045	4.266	45
30	5.416	2.583	6.318	3.014	7.221	3.444	8.123	3.875	9.026	4.305	30
45	5.404	2.607	6.305	3.041	7.206	3.476	8.106	3.910	9.007	4.345	15
26 0	5.393	2.630	6.292	3.069	7.190	3.507	8.089	3.945	8.988	4.384	64 0
15	5.381	2.654	6.278	3.096	7.175	3.538	8.072	3.981	8.969	4.423	45
30	5.370	2.677	6.265	3.123	7.160	3.570	8.054	4.016	8.949	4.462	30
45	5.358	2.701	6.251	3.151	7.144	3.601	8.037	4.051	8.930	4.501	15
27 0	5.346	2.724	6.237	3.178	7.128	3.632	8.019	4.086	8.910	4.540	63 0
15	5.334	2.747	6.223	3.205	7.112	3.663	8.001	4.121	8.890	4.579	45
30	5.322	2.770	6.209	3.232	7.096	3.694	7.983	4.156	8.870	4.618	30
45	5.310	2.794	6.195	3.259	7.080	3.725	7.965	4.190	8.850	4.656	15
28 0	5.298	2.817	6.181	3.286	7.064	3.756	7.947	4.225	8.829	4.695	62 0
15	5.285	2.840	6.166	3.313	7.047	3.787	7.928	4.260	8.809	4.733	45
30	5.273	2.863	6.152	3.340	7.031	3.817	7.909	4.294	8.788	4.772	30
45	5.260	2.886	6.137	3.367	7.014	3.848	7.891	4.329	8.767	4.810	15
29 0	5.248	2.909	6.122	3.394	6.997	3.878	7.872	4.363	8.746	4.848	61 0
15	5.235	2.932	6.107	3.420	6.980	3.909	7.852	4.398	8.725	4.886	45
30	5.222	2.955	6.093	3.447	6.963	3.939	7.833	4.432	8.704	4.924	30
45	5.209	2.977	6.077	3.474	6.946	3.970	7.814	4.466	8.682	4.962	15
30 0	5.196	3.000	6.062	3.500	6.928	4.000	7.794	4.500	8.660	5.000	60 0
° ′	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	° ′
Bearing.	Distance 6.		Distance 7.		Distance 8.		Distance 9.		Distance 10.		Bearing.

30°— 45°

Bearing.	Distance 1.		Distance 2.		Distance 3.		Distance 4.		Distance 5.		Bearing.
° ′	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	° ′
30 15	0.864	0.504	1.728	1.008	2.592	1.511	3.455	2.015	4.319	2.519	59 45
30	0.862	0.508	1.723	1.015	2.585	1.523	3.447	2.030	4.308	2.538	30
45	0.859	0.511	1.719	1.023	2.578	1.534	3.438	2.045	4.297	2.556	15
31 0	0.857	0.515	1.714	1.030	2.572	1.545	3.429	2.060	4.286	2.575	59 0
15	0.855	0.519	1.710	1.038	2.565	1.556	3.420	2.075	4.275	2.594	45
30	0.853	0.522	1.705	1.045	2.558	1.567	3.411	2.090	4.263	2.612	30
45	0.850	0.526	1.701	1.052	2.551	1.579	3.401	2.105	4.252	2.631	15
32 0	0.848	0.530	1.696	1.060	2.544	1.590	3.392	2.120	4.240	2.650	58 0
15	0.846	0.534	1.691	1.067	2.537	1.601	3.383	2.134	4.229	2.668	45
30	0.843	0.537	1.687	1.075	2.530	1.612	3.374	2.149	4.217	2.686	30
45	0.841	0.541	1.682	1.082	2.523	1.623	3.364	2.164	4.205	2.705	15
33 0	0.839	0.545	1.677	1.089	2.516	1.634	3.355	2.179	4.193	2.723	57 0
15	0.836	0.548	1.673	1.097	2.509	1.645	3.345	2.193	4.181	2.741	45
30	0.834	0.552	1.668	1.104	2.502	1.656	3.336	2.208	4.169	2.760	30
45	0.831	0.556	1.663	1.111	2.494	1.667	3.326	2.222	4.157	2.778	15
34 0	0.829	0.559	1.658	1.118	2.487	1.678	3.316	2.237	4.145	2.796	56 0
15	0.827	0.563	1.653	1.126	2.480	1.688	3.306	2.251	4.133	2.814	45
30	0.824	0.566	1.648	1.133	2.472	1.699	3.297	2.266	4.121	2.832	30
45	0.822	0.570	1.643	1.140	2.465	1.710	3.287	2.280	4.108	2.850	15
35 0	0.819	0.574	1.638	1.147	2.457	1.721	3.277	2.294	4.096	2.868	55 0
15	0.817	0.577	1.633	1.154	2.450	1.731	3.267	2.309	4.083	2.886	45
30	0.814	0.581	1.628	1.161	2.442	1.742	3.257	2.323	4.071	2.904	30
45	0.812	0.584	1.623	1.168	2.435	1.753	3.246	2.337	4.058	2.921	15
36 0	0.809	0.588	1.618	1.176	2.427	1.763	3.236	2.351	4.045	2.939	54 0
15	0.806	0.591	1.613	1.183	2.419	1.774	3.226	2.365	4.032	2.957	45
30	0.804	0.595	1.608	1.190	2.412	1.784	3.215	2.379	4.019	2.974	30
45	0.801	0.598	1.603	1.197	2.404	1.795	3.205	2.393	4.006	2.992	15
37 0	0.799	0.602	1.597	1.204	2.396	1.805	3.195	2.407	3.993	3.009	53 0
15	0.796	0.605	1.592	1.211	2.388	1.816	3.184	2.421	3.980	3.026	45
30	0.793	0.609	1.587	1.218	2.380	1.826	3.173	2.435	3.967	3.044	30
45	0.791	0.612	1.581	1.224	2.372	1.837	3.163	2.449	3.953	3.061	15
38 0	0.788	0.616	1.576	1.231	2.364	1.847	3.152	2.463	3.940	3.078	52 0
15	0.785	0.619	1.571	1.238	2.356	1.857	3.141	2.476	3.927	3.095	45
30	0.783	0.623	1.565	1.245	2.348	1.868	3.130	2.490	3.913	3.113	30
45	0.780	0.626	1.560	1.252	2.340	1.878	3.120	2.504	3.899	3.130	15
39 0	0.777	0.629	1.554	1.259	2.331	1.888	3.109	2.517	3.886	3.147	51 0
15	0.774	0.633	1.549	1.265	2.323	1.898	3.098	2.531	3.872	3.164	45
30	0.772	0.636	1.543	1.272	2.315	1.908	3.086	2.544	3.858	3.180	30
45	0.769	0.639	1.538	1.279	2.307	1.918	3.075	2.558	3.844	3.197	15
40 0	0.766	0.643	1.532	1.286	2.298	1.928	3.064	2.571	3.830	3.214	50 0
15	0.763	0.646	1.526	1.292	2.290	1.938	3.053	2.584	3.816	3.231	45
30	0.760	0.649	1.521	1.299	2.281	1.948	3.042	2.598	3.802	3.247	30
45	0.758	0.653	1.515	1.306	2.273	1.958	3.030	2.611	3.788	3.264	15
41 0	0.755	0.656	1.509	1.312	2.264	1.968	3.019	2.624	3.774	3.280	49 0
15	0.752	0.659	1.504	1.319	2.256	1.978	3.007	2.637	3.759	3.297	45
30	0.749	0.663	1.498	1.325	2.247	1.988	2.996	2.650	3.745	3.313	30
45	0.746	0.666	1.492	1.332	2.238	1.998	2.984	2.664	3.730	3.329	15
42 0	0.743	0.669	1.486	1.338	2.229	2.007	2.973	2.677	3.716	3.346	48 0
15	0.740	0.672	1.480	1.345	2.221	2.017	2.961	2.689	3.701	3.362	45
30	0.737	0.676	1.475	1.351	2.212	2.027	2.949	2.702	3.686	3.378	30
45	0.734	0.679	1.469	1.358	2.203	2.036	2.937	2.715	3.672	3.394	15
43 0	0.731	0.682	1.463	1.364	2.194	2.046	2.925	2.728	3.657	3.410	47 0
15	0.728	0.685	1.457	1.370	2.185	2.056	2.913	2.741	3.642	3.426	45
30	0.725	0.688	1.451	1.377	2.176	2.065	2.901	2.753	3.627	3.442	30
45	0.722	0.692	1.445	1.383	2.167	2.075	2.889	2.766	3.612	3.458	15
44 0	0.719	0.695	1.439	1.389	2.158	2.084	2.877	2.779	3.597	3.473	46 0
15	0.716	0.698	1.433	1.396	2.149	2.093	2.865	2.791	3.582	3.489	45
30	0.713	0.701	1.427	1.402	2.140	2.103	2.853	2.804	3.566	3.505	30
45	0.710	0.704	1.420	1.408	2.131	2.112	2.841	2.816	3.551	3.520	15
45 0	0.707	0.707	1.414	1.414	2.121	2.121	2.828	2.828	3.536	3.536	45 0
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30 15	5.183	3.023	6.047	3.526	6.911	4.030	7.775	4.534	8.638	5.038	59 45
30	5.170	3.045	6.031	3.553	6.893	4.060	7.755	4.568	8.616	5.075	30
45	5.156	3.068	6.016	3.579	6.875	4.090	7.735	4.602	8.594	5.113	15
31 0	5.143	3.090	6.000	3.605	6.857	4.120	7.715	4.635	8.572	5.150	59 0
15	5.129	3.113	5.984	3.631	6.839	4.150	7.694	4.669	8.549	5.188	45
30	5.116	3.135	5.968	3.657	6.821	4.180	7.674	4.702	8.526	5.225	30
45	5.102	3.157	5.952	3.683	6.803	4.210	7.653	4.736	8.504	5.262	15
32 0	5.088	3.180	5.936	3.709	6.784	4.239	7.632	4.769	8.481	5.299	58 0
15	5.074	3.202	5.920	3.735	6.766	4.269	7.612	4.802	8.457	5.336	45
30	5.060	3.224	5.904	3.761	6.747	4.298	7.591	4.836	8.434	5.373	30
45	5.046	3.246	5.887	3.787	6.728	4.328	7.569	4.869	8.410	5.410	15
33 0	5.032	3.268	5.871	3.812	6.709	4.357	7.548	4.902	8.387	5.446	57 0
15	5.018	3.290	5.854	3.838	6.690	4.386	7.527	4.935	8.363	5.483	45
30	5.003	3.312	5.837	3.864	6.671	4.416	7.505	4.967	8.339	5.519	30
45	4.989	3.333	5.820	3.889	6.652	4.445	7.483	5.000	8.315	5.556	15
34 0	4.974	3.355	5.803	3.914	6.632	4.474	7.461	5.033	8.290	5.592	56 0
15	4.960	3.377	5.786	3.940	6.613	4.502	7.439	5.065	8.266	5.628	45
30	4.945	3.398	5.769	3.965	6.593	4.531	7.417	5.098	8.241	5.664	30
45	4.930	3.420	5.752	3.990	6.573	4.560	7.395	5.130	8.217	5.700	15
35 0	4.915	3.441	5.734	4.015	6.553	4.589	7.372	5.162	8.192	5.736	55 0
15	4.900	3.463	5.716	4.040	6.533	4.617	7.350	5.194	8.166	5.772	45
30	4.885	3.484	5.699	4.065	6.513	4.646	7.327	5.226	8.141	5.807	30
45	4.869	3.505	5.681	4.090	6.493	4.674	7.304	5.258	8.116	5.843	15
36 0	4.854	3.527	5.663	4.115	6·472	4.702	7.281	5.290	8.090	5.878	54 0
15	4.839	3.548	5.645	4.139	6.452	4.730	7.258	5.322	8.064	5.913	45
30	4.823	3.569	5.627	4.164	6.431	4.759	7.235	5.353	8.039	5.948	30
45	4.808	3.590	5.609	4.188	6.410	4.787	7.211	5.385	8.013	5.983	15
37 0	4.792	3.611	5.590	4.213	6.389	4.815	7.188	5.416	7.986	6.018	53 0
15	4.776	3.632	5.572	4.237	6.368	4.842	7.164	5.448	7.960	6.053	45
30	4.760	3.653	5.554	4.261	6.347	4.870	7.140	5.479	7.934	6.088	30
45	4.744	3.673	5.535	4.286	6.326·	4.898	7.116	5.510	7.907	6.122	15
38 0	4.728	3.694	5.516	4.310	6.304	4.925	7.092	5.541	7.880	6.157	52 0
15	4.712	3.715	5.497	4.334	6.283	4.953	7.068	5.572	7.853	6.191	45
30	4.696	3.735	5.478	4.358	6.261	4.980	7.043	5.603	7.826	6.225	30
45	4.679	3.756	5.459	4.381	6.239	5.007	7.019	5.633	7.799	6.259	15
39 0	4.663	3.776	5.440	4.405	6.217	5.035	6.994	5.664	7.772	6.293	51 0
15	4.646	3.796	5.421	4.429	6.195	5.062	6.970	5.694	7.744	6.327	45
30	4.630	3.816	5.401	4.453	6.173	5.089	6.945	5.725	7.716	6.361	30
45	4.613	3.837	5.382	4.476	6.151	5.116	6.920	5.755	7.688	6.394	15
40 0	4.596	3.857	5.362	4.500	6.128	5.142	6.894	5.785	7.660	6.428	50 0
15	4.579	3.877	5.343	4.523	6.106	5.169	6.869	5.815	7.632	6.461	45
30	4.562	3.897	5.323	4.546	6.083	5.196	6.844	5.845	7.604	6.495	30
45	4.545	3.917	5.303	4.569	6.061	5.222	6.818	5.875	7.576	6.528	15
41 0	4.528	3.936	5.283	4.592	6.038	5.248	6.792	5.905	7.547	6.561	49 0
15	4.511	3.956	5.263	4.615	6.015	5.275	6.767	5.934	7.518	6.594	45
30	4.494	3.976	5.243	4.638	5.992	5.301	6.741	5.964	7.490	6.626	30
45	4.476	3.995	5.222	4.661	5.968	5.327	6.715	5.993	7.461	6.659	15
42 0	4.459	4.015	5.202	4.684	5.945	5.353	6.688	6.022	7.431	6.691	48 0
15	4.441	4.034	5.182	4.707	5.922	5.379	6.662	6.051	7.402	6.724	45
30	4.424	4.054	5.161	4.729	5.898	5.405	6.635	6.080	7.373	6.756	30
45	4.406	4.073	5.140	4.752	5.875	5.430	6.609	6.109	7.343	6.788	15
43 0	4.388	4.092	5.119	4.774	5.851	5.456	6.582	6.138	7.314	6.820	47 0
15	4.370	4.111	5.099	4.796	5.827	5.481	6.555	6.167	7.284	6.852	45
30	4.352	4.130	5.078	4.818	5.803	5.507	6.528	6.195	7.254	6.884	30
45	4.334	4.149	5.057	4.841	5.779	5.532	6.501	6.224	7.224	6.915	15
44 0	4.316	4.168	5.035	4.863	5.755	5.557	6.474	6.252	7.193	6.947	46 0
15	4.298	4.187	5.014	4.885	5.730	5.582	6.447	6.280	7.163	6.978	45
30	4.280	4.206	4.993	4.906	5.706	5.607	6.419	6.308	7.133	7.009	30
45	4.261	4.224	4.971	4.928	5.681	5.632	6.392	6.336	7.102	7.040	15
45 0	4.243	4.243	4.950	4.950	5.657	5.657	6.364	6.364	7.071	7.071	45 0
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